HAMEG®
Instruments

Oscilloscope
HM 304

ENGLISH 4S-0304-00E0 01 OCT 1997

SERVICE-MANUAL HM304

Service Manual
Adjustment Procedure
Circuit Diagrams

HM304

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St. 011097. Hüb/Schm

Printed in Germany

Specifications

Vertical Deflection

Operating modes: Channel I or II separate, both Channels (alternated or chopped), (Chopper frequency approx. 0.5MHz).
Sum or **difference** with Ch. I and Ch. II (both channels invertable).
XY-Mode: via channel I and channel II
Frequency range: 2xDC to 35MHz (-3dB)
Risetime: <10ns. Overshoot max. 1%.
Deflection coefficients: 14 calibrated steps from **1mV/div.** to **20V/div.** (1-2-5 sequence) with variable 2.5:1 up to **50V/div.**
Accuracy in calibrated position:
1mV/div. to 2mV/div.: ±5%(0 to 10MHz (-3dB))
5mV/div. to 20V/div.: ±3%
Input impedance: 1MΩ II 20pF.
Input coupling: DC-AC-GD (ground).
Input voltage: max. 400V (DC + peak AC).

Triggering

Automatic: (peak to peak) **<20Hz-100MHz** (≤ 0.5div.)
Normal with level control: **DC-100MHz** (≤0.5div.)
Slope: positive or negative,
ALT. Triggering; LED indicator for trigger action
Sources: Channel I or II, CH. I alternating CH II, line and external
Coupling: **AC** (10Hz to 100MHz), **DC** (0 to 100MHz), **HF** (1.5kHz to100MHz), **LF** (0 to 1.5kHz)
Active TV-Sync-Separator (pos. and neg.)
External: ≥0.3V_{pp} from DC to 50MHz
2nd triggering (Del. Trig.): normal with level control DC to 100MHz

Horizontal Deflection

Time coefficients: 22 calibrated steps from 0.5s/div. to 50ns/div. in 1-2-5 sequence
Accuracy in calibrated position: ±3%.
variable 2.5:1 up to 1.25s/div.,
with X-Mag. x10: 10ns/div. ±5%
Holdoff time: variable to approx. 10:1
Delay: 50ms - 100ns, variable 2.5:1 up to 125ms
Bandwidth X-amplifier: 0-2.5MHz (-3dB).
Input X-Amplifier via Channel II,
(sensitivity see Channel II specification)
X-Y phase shift: <3° below 120kHz.

Operation / Control

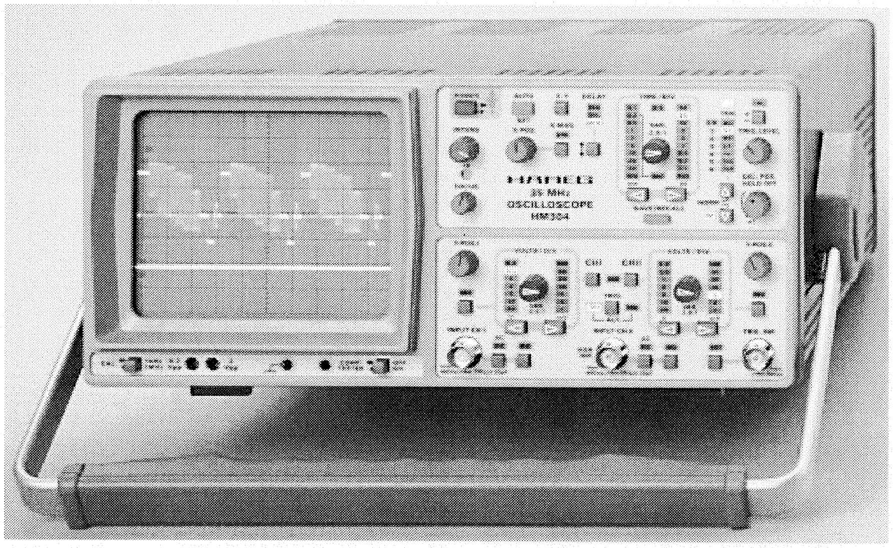
Auto Set (automatic parameter selection)
Manual (Front Panel switches)
Memory for 6 user-defined parameter settings
Remote control with built-in RS-232 interface

Component Tester

Test voltage: approx. 8.5V_{rms} (open circuit).
Test current: approx. 7mA_{rms} (shorted).
Test frequency: approx. 50Hz
Test connection: 2 banana jacks 4mm´Ø
One test lead is grounded (Safety Earth)

General Information

CRT: D14-364GY/123 or ER151-GH/-,rectangular screen (8x10cm) internal graticule
Acceleration voltage: approx 2000V
Trace rotation: adjustable on front panel
Calibrator: square-wave generator (t_r <4ns) ≈1kHz/1MHz; Output: 0.2V ±1% and 2V
Line voltage: 100-240V AC ±10%, 50/60Hz
Power consumption: approx. 34 Watt at 50Hz.
Min./Max. ambient temperature: 0°C...+40°C
Protective system: Safety class I (IEC1010-1)
Weight: approx. 5.6kg (12.4lbs), color: techno-brown
Cabinet: W 285, H 125, D 380 mm (11.1x4.9x14.8 inches)
Lockable tilt handle



35MHz Analog-Oscilloscope HM304

with Auto-Set, Save and Recall (6 Setup Memories) Remote control via built-in RS-232 Interface

Vertical: 2 Channels, 1 mV/div to 20 V/div., Component Tester
Time Base: 0.5 s/div. to 10 ns/div.; Trigger-after-delay; Alternate Trigger
Triggering: DC to 100 MHz; Automatic Peak to Peak; TV-Sync-Separator

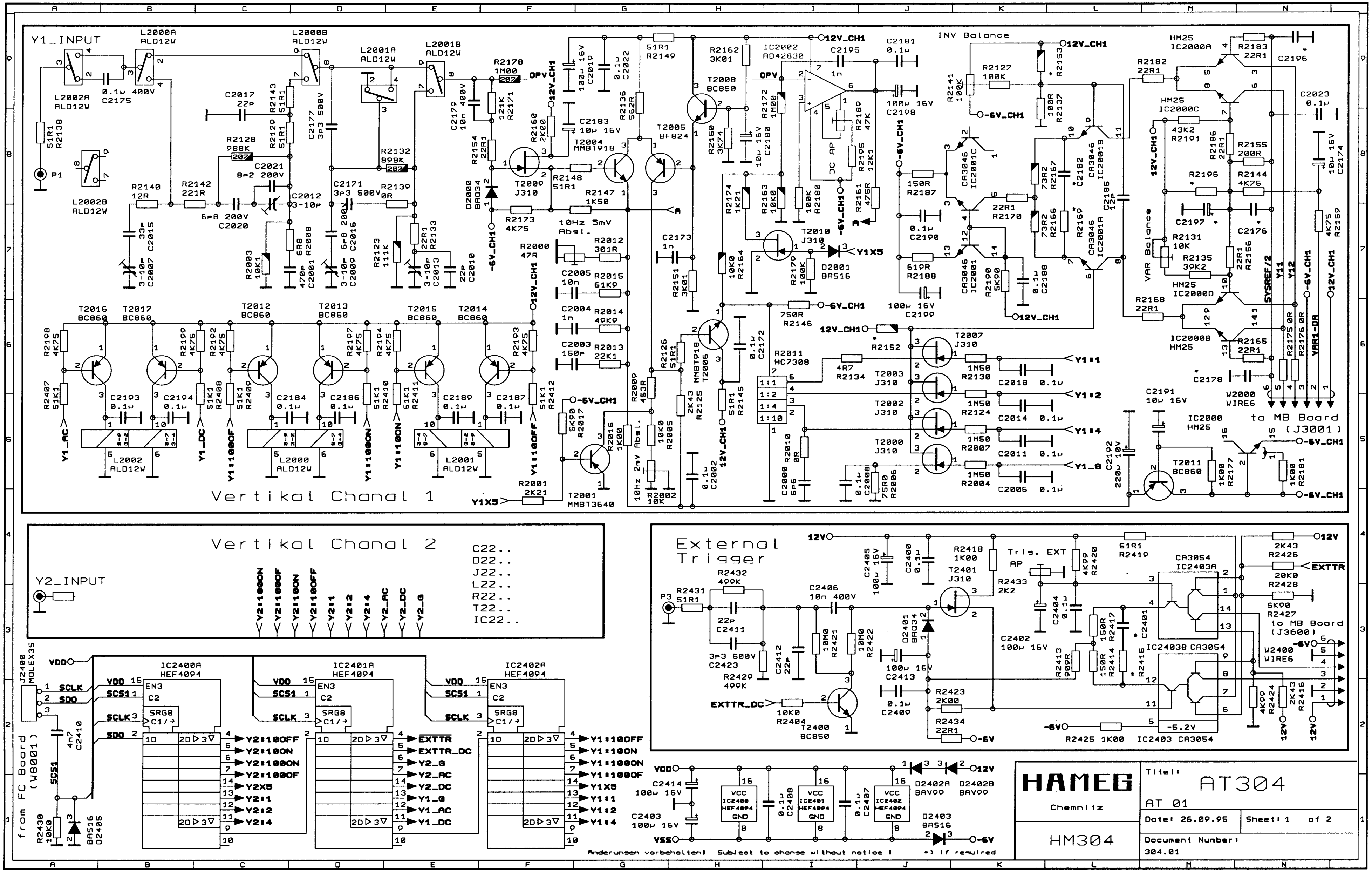
The requirements of modern service and industrial applications can easily be met with **HAMEG's HM 304 microprocessor** controlled oscilloscope. The new **"AUTO SET"** capability allows for automatic setup, where the user need only adjust the focus and intensity controls. All other settings instantaneously and automatically configure in response to the input signals when "AUTO SET" is active. The instrument's intelligence modifies only those parameters that are necessary for proper signal presentation. This mode typically generates a display with a period of three signal repetitions, that has an amplitude of approximately six divisions for single channel and half of that for dual channel operation. Manual control is also possible for all settings. A **PC's serial port** can control remote operation via the **RS-232** serial interface. **LED's** indicate measurement range settings and functions.

A memory base that can store six different customer-defined control scenarios facilitates repeat measurement tasks. User settings can be saved and recalled without restriction.

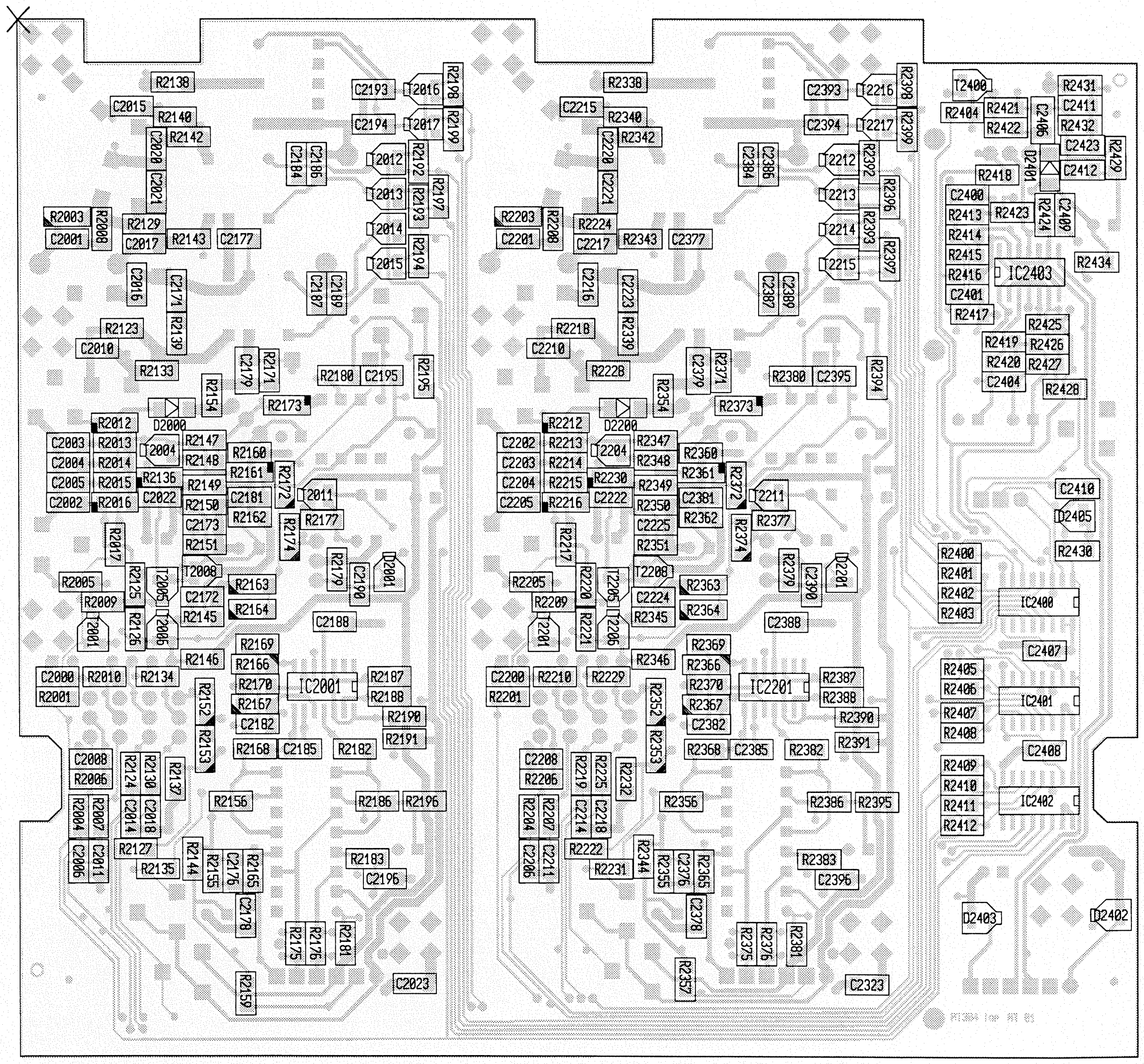
The two vertical (Y) channel amplifier's **35 MHz** bandwidth display signals over **100 MHz**. High frequency trigger circuitry permits synchronization to signals (having 0.5 division amplitude) beyond 100 MHz. The high resolution timebase allows signal expansion in the 'delay' and 'trigger after delay' modes by a factor of up to 1,000 times. The HM304 is equipped with a built-in **Component Tester**, dual frequency (1 kHz / 1 MHz) calibration signals and mu-metal CRT shielding. A switching mode power supply saves both energy and weight with the complete unit weighing only 5.5 kg. (12.1 pounds).

This unit offers attributes, only too easy to get used to, that are beyond compare to other instruments in this price range. Expert users will rapidly identify that the HM304's deluxe suite of features shall be the standard for future high performance oscilloscopes.

Accessories supplied: Line Cord, Operators Manual, 2 Probes 1:1/10:1


Vertikal Chanal 1
Vertikal Chanal 2
C22..
D22..
J22..
L22..
R22..
T22..
IC22..
External Trigger
Y1_INPUT
Y2_INPUT
INV Balance
VAR Balance
to MB Board (J3001)
W2000 WIRE6
to MB Board (J3600)
W2400 WIRE6
from FC Board (W8001)
J2400 MOLEX3S
IC2400A HEF4094
IC2401A HEF4094
IC2402A HEF4094
IC2002 AD42830
HAMEG
Chemnitz
Titel:
AT304
AT 01
Date: 26.09.95
Sheet: 1 of 2
HM304
Document Number:
304.01
Änderungen vorbehalten! Subject to change without notice !
*) if required

AT-Board (Bottomside)


R2138
C2193
T2016
R2198
C2015
R2140
R2142
C2194
T2017
R2199
C2020
C2184
C2186
T2012
R2192
C2021
T2013
R2193
R2197
R2003
R2008
R2129
C2001
C2017
R2143
C2177
T2014
T2015
R2194
C2016
C2171
R2139
C2187
C2189
R2123
C2010
R2133
C2179
R2171
R2180
C2195
R2195
R2154
R2173
R2012
D2000
C2003
R2013
T2004
R2147
R2160
C2004
R2014
R2148
R2161
R2172
C2005
R2015
R2136
R2149
T2011
C2002
R2016
C2022
R2150
C2181
C2173
R2162
R2177
R2174
R2151
R2017
T2008
R2179
C2190
D2001
R2005
R2125
T2005
C2172
R2163
R2009
R2145
R2164
T2001
R2126
T2006
C2188
R2169
R2146
R2166
C2000
R2010
R2134
R2170
IC2001
R2187
R2001
R2152
R2167
R2188
R2190
C2182
R2153
R2191
C2008
R2124
R2130
R2137
R2168
C2185
R2182
R2006
R2156
R2186
R2196
R2004
R2007
C2014
C2018
C2006
C2011
R2127
R2144
R2155
C2176
R2165
R2183
R2135
C2196
C2178
R2175
R2176
R2181
R2159
C2023
R2338
C2393
T2216
R2398
C2215
R2340
R2342
C2394
T2217
R2399
C2220
C2384
C2386
T2212
R2392
C2221
T2213
R2396
R2203
R2208
R2224
R2393
C2201
C2217
R2343
C2377
T2214
R2397
T2215
C2216
C2223
C2387
C2389
R2218
C2210
R2339
R2228
C2379
R2371
R2380
C2395
R2394
R2354
R2373
R2212
D2200
C2202
R2213
T2204
R2347
R2360
C2203
R2214
R2348
R2361
R2372
C2204
R2215
R2230
R2349
T2211
C2205
R2216
C2222
R2350
C2381
R2362
R2377
C2225
R2217
R2351
R2374
T2208
R2379
C2390
D2201
R2205
R2220
T2205
C2224
R2363
R2209
R2345
R2364
T2201
R2221
T2206
C2388
R2369
R2346
R2366
C2200
R2210
R2229
R2370
IC2201
R2387
R2201
R2352
R2367
R2388
R2390
C2382
R2353
R2391
C2208
R2219
R2225
R2232
R2368
C2385
R2382
R2206
R2356
R2386
R2395
R2204
R2207
C2214
C2218
C2206
C2211
R2222
R2344
R2355
C2376
R2365
R2383
R2231
C2396
C2378
R2375
R2376
R2381
R2357
C2323
T2400
R2431
R2404
R2421
C2406
C2411
R2422
R2432
C2423
R2429
D2401
R2418
C2412
C2400
R2423
R2424
C2409
R2413
R2414
R2415
IC2403
R2434
R2416
C2401
R2417
R2425
R2419
R2426
R2420
R2427
C2404
R2428
C2410
D2405
R2430
R2400
R2401
R2402
IC2400
R2403
C2407
R2405
R2406
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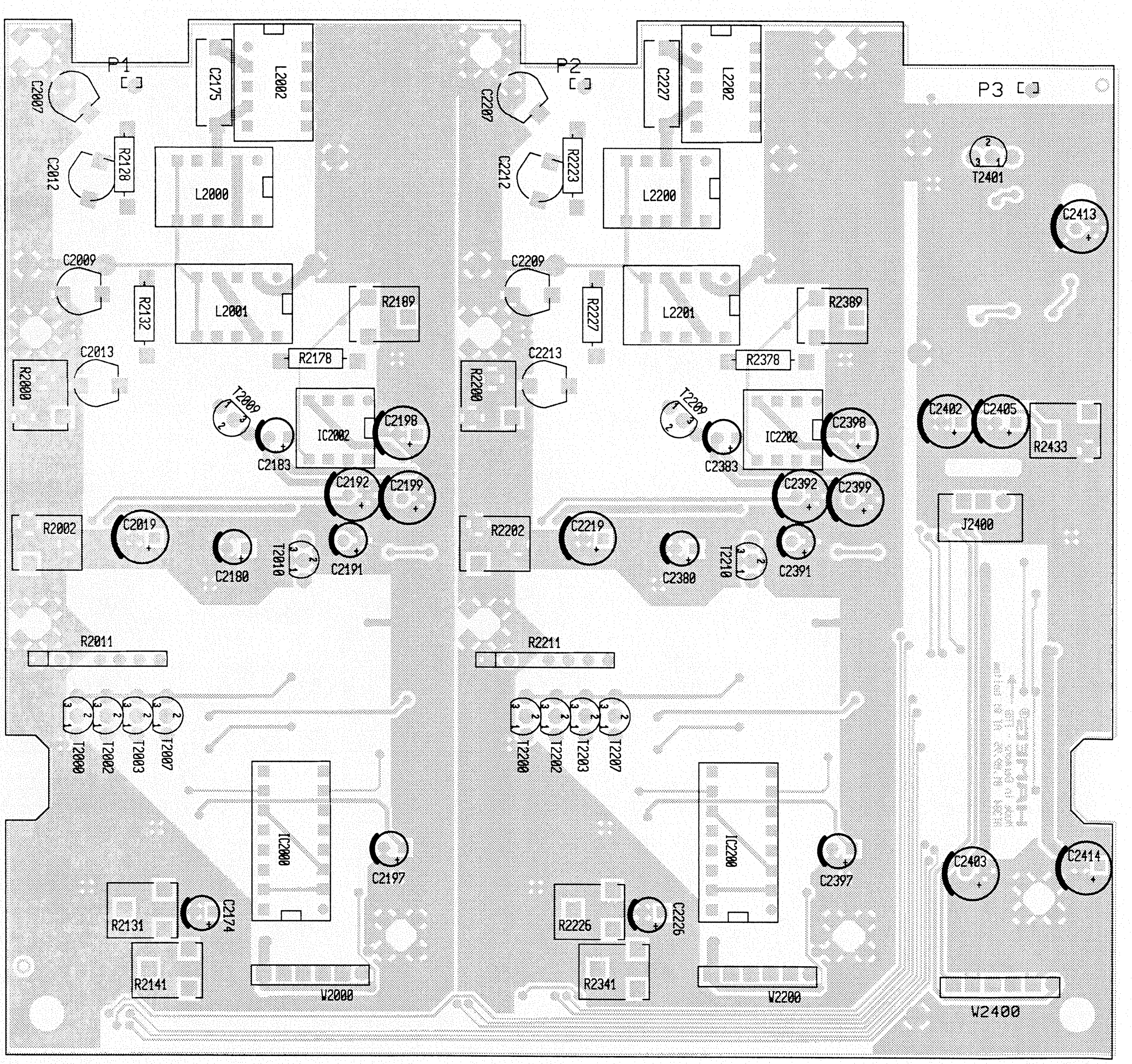
IC2402
R2411
R2412
D2403
D2402


P1
C2007
C2175
L2002
C2012
R2128
L2000
C2009
R2132
L2001
R2109
R2178
C2013
R2000
T2009
C2183
IC2002
C2198
C2192
C2199
R2002
C2019
C2180
T2010
C2191
R2011
T2000
T2002
T2003
T2007
IC2000
C2197
R2131
C2174
R2141
W2000
P2
C2207
C2227
L2202
C2212
R2223
L2200
C2209
R2227
L2201
R2389
R2378
C2213
R2200
T2209
C2383
IC2202
C2398
C2392
C2399
R2202
C2219
C2380
T2210
C2391
R2211
T2200
T2202
T2203
T2207
IC2200
C2397
R2226
C2226
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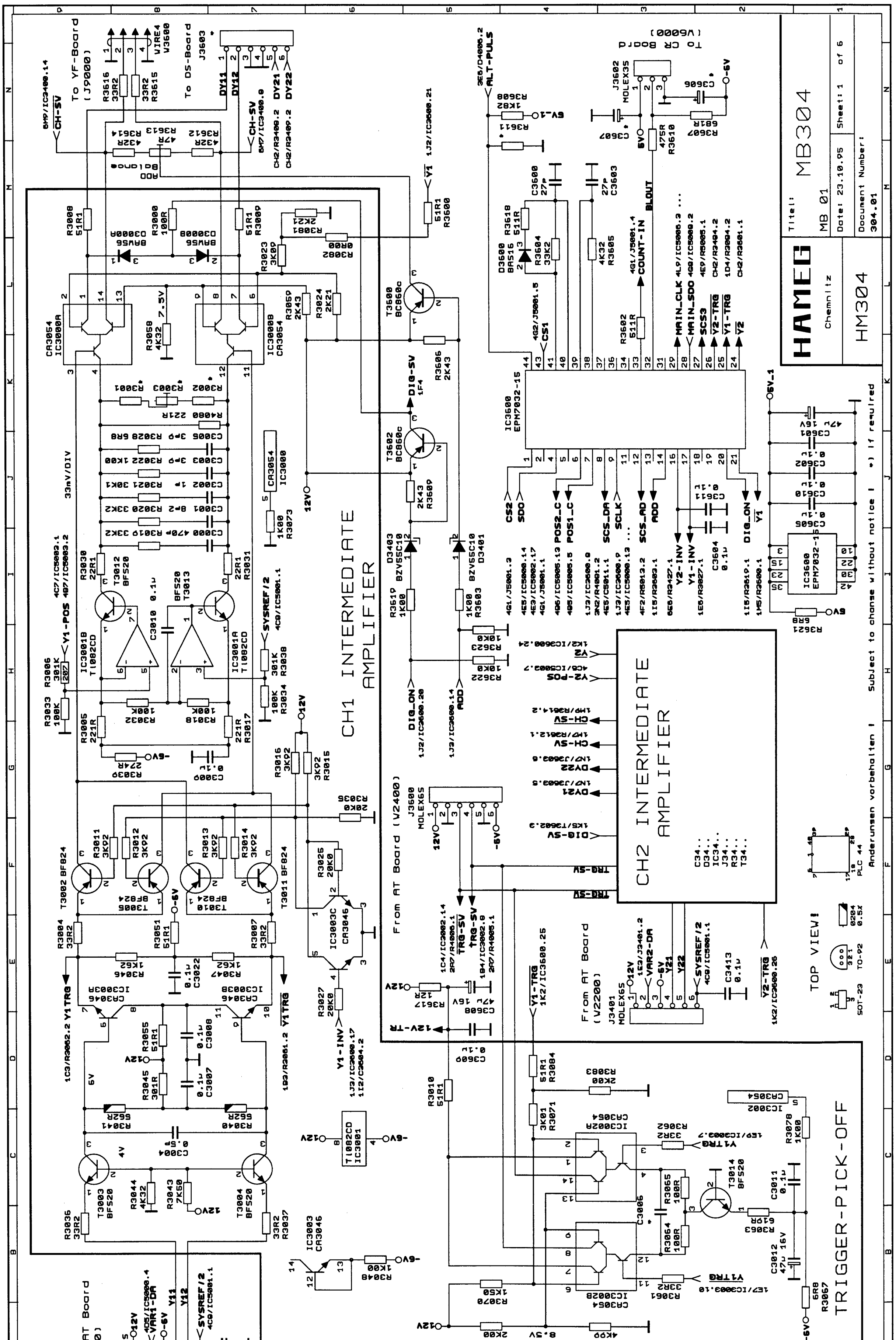
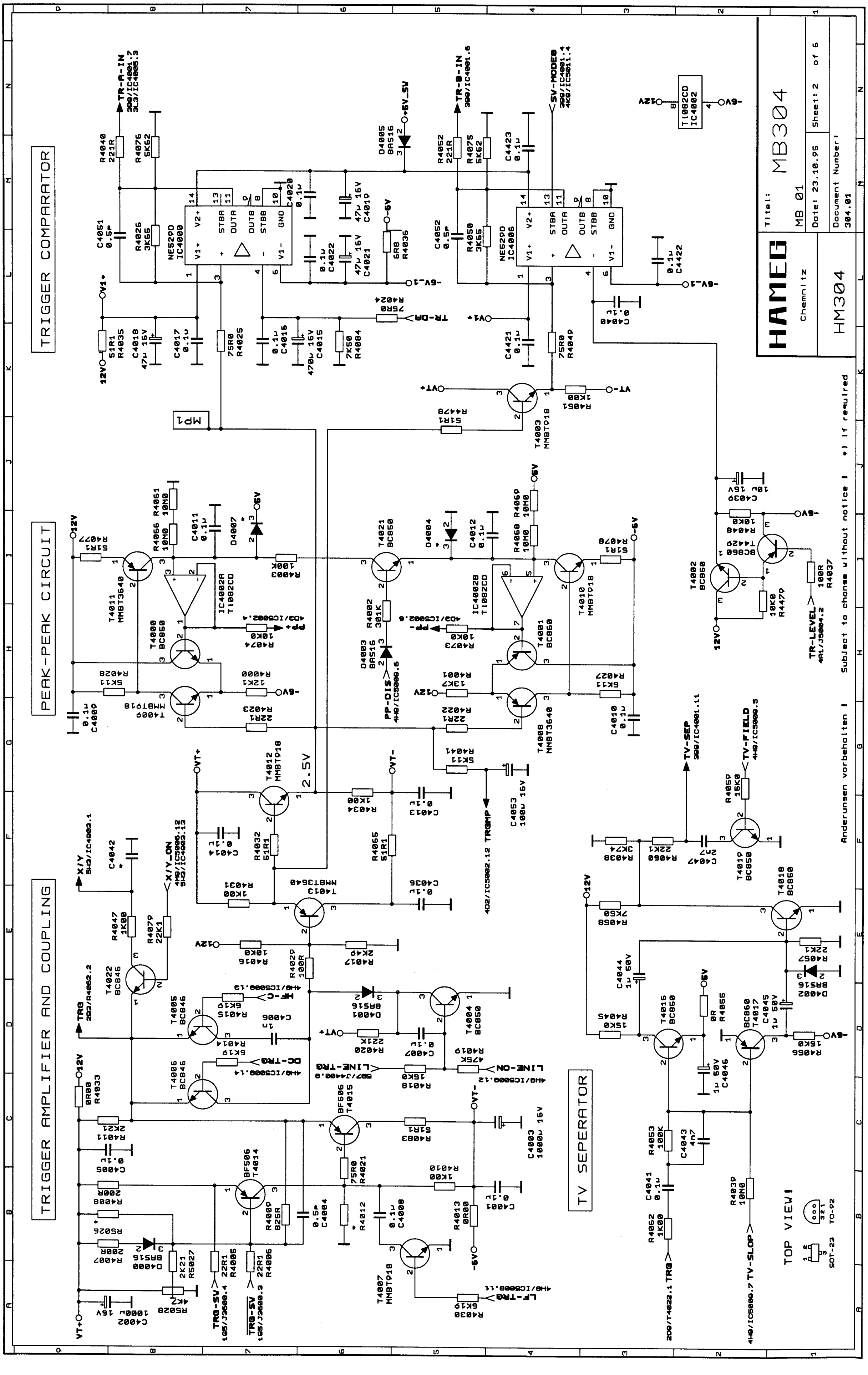
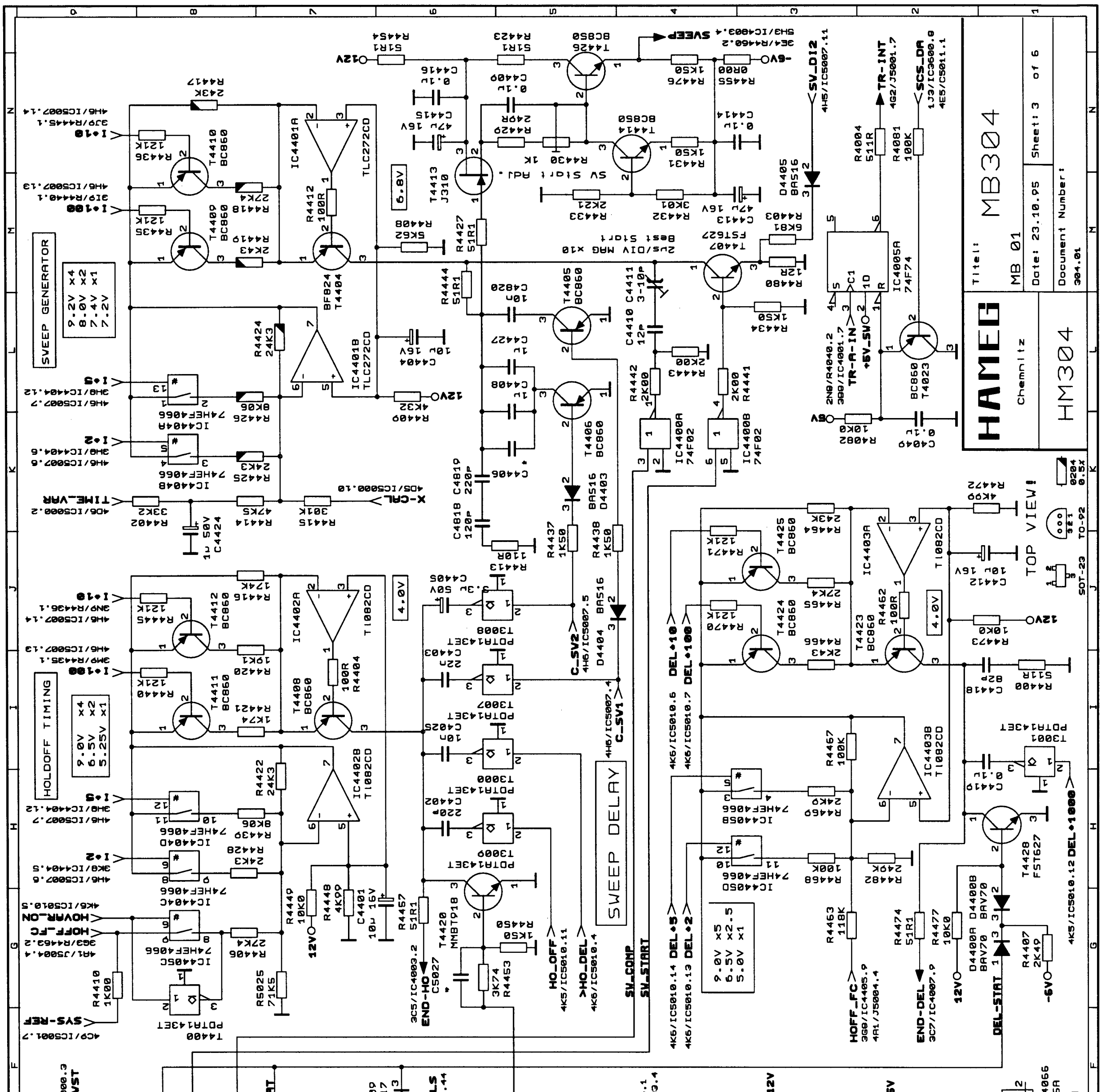
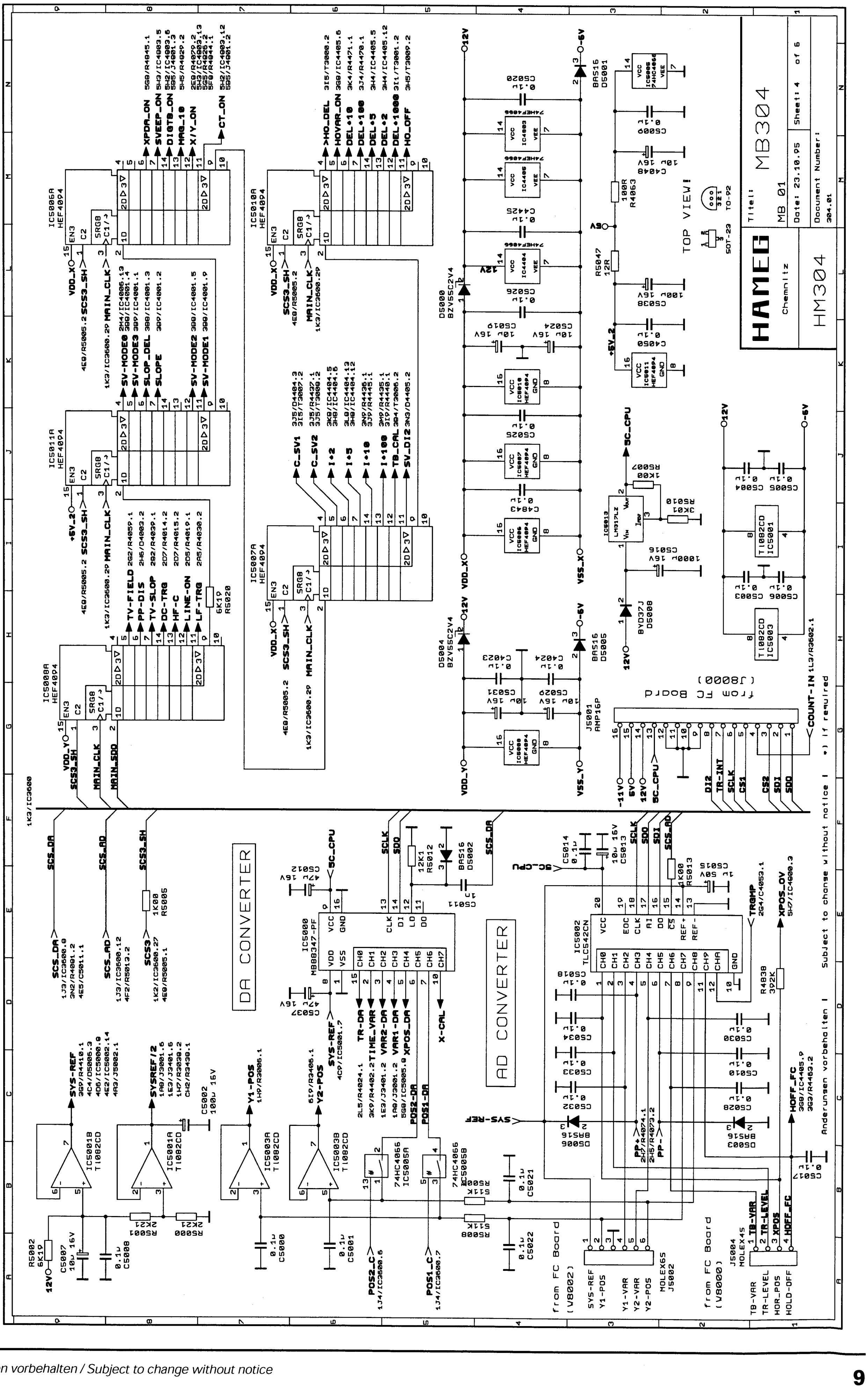
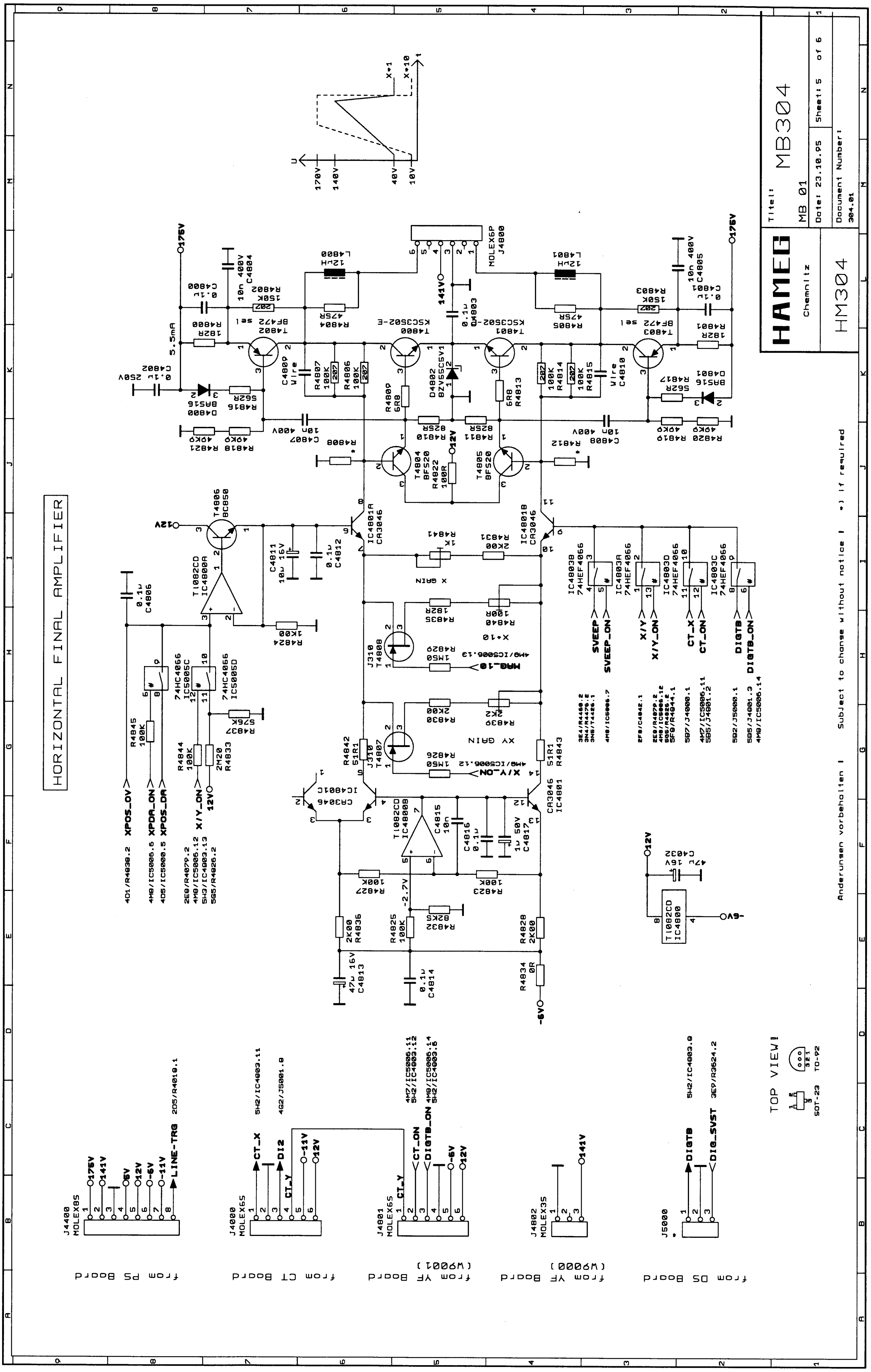
R2433
J2400
C2403
C2414
W2400

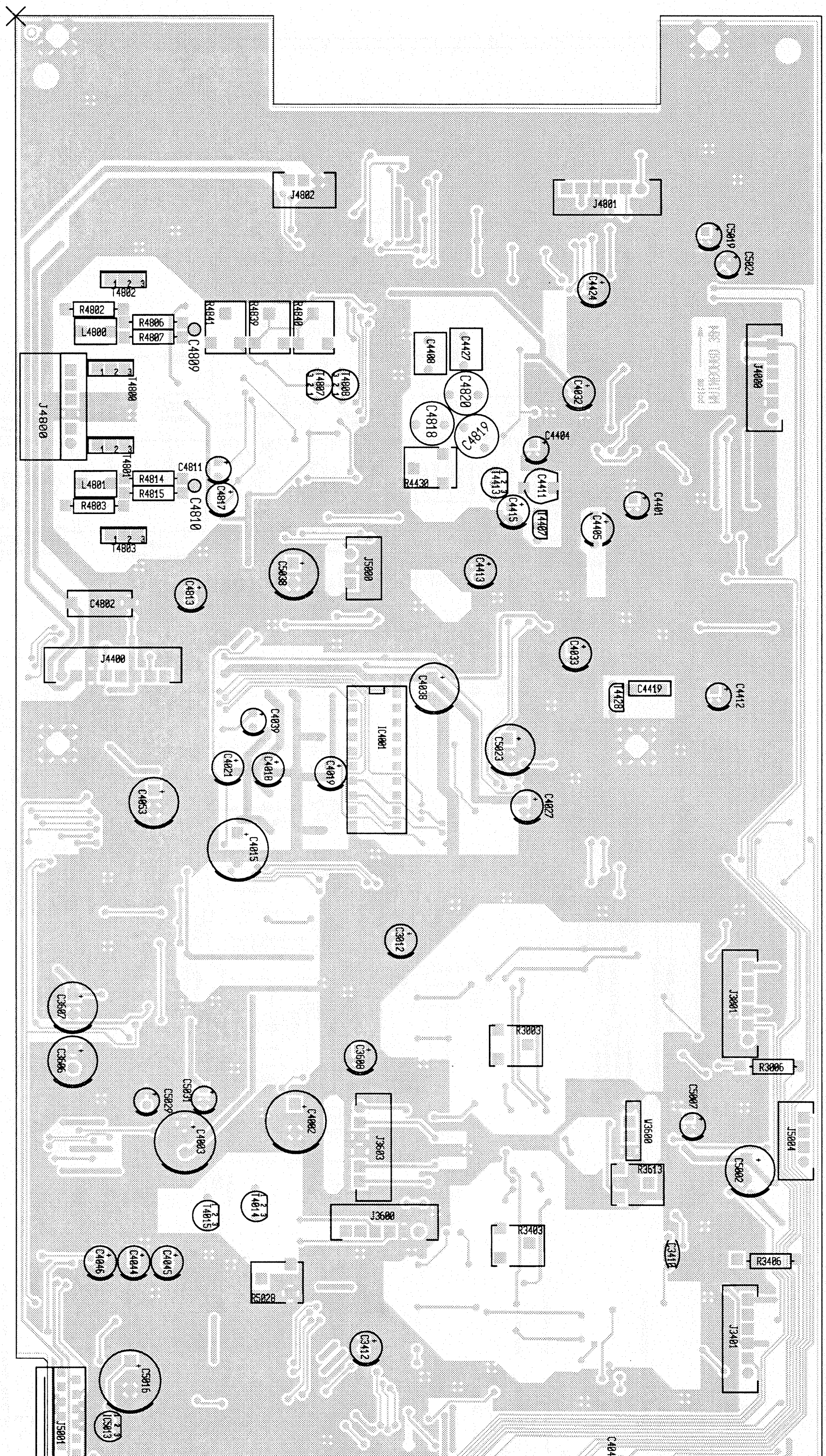

CH1 INTERMEDIATE AMPLIFIER
CH2 INTERMEDIATE AMPLIFIER
TRIGGER-PICK-OFF
To YF-Board (J9000)
To DS-Board
To CR Board (V6000)
From AT Board (V2400)
From AT Board (V2200)
From AT Board (V2000)
TOP VIEW!
HAMEG
Chemnitz
HM304
MB304
Title: MB 01
Date: 23.10.95
Sheet: 1 of 6
Document Number: 304.01
Änderungen vorbehalten ! Subject to change without notice ! *) if required


TRIGGER COMPARATOR
PEAK-PEAK CIRCUIT
TRIGGER AMPLIFIER AND COUPLING
TV SEPERATOR
HAMEG
Chemnitz
HM304
Titel: MB304
MB 01
Date: 23.10.95
Sheet: 2 of 6
Document Number: 304.01
TOP VIEW!
SOT-23
TO-92
Änderungen vorbehalten ! Subject to change without notice ! *) if required
TR-A-IN
TR-B-IN
SV-MODE0
TR-LEVEL
TV-SEP
TV-FIELD
TRG
X/Y
X/Y_ON
HF-C
DC-TRG
LINE-TRG
LINE-ON
LF-TRG
TRG-SV
TV-SLOP
PP+
PP-
PP-DIS
TRAMP
MP1
2.5V
NE529D IC4000
NE529D IC4005
TL082CD IC4002

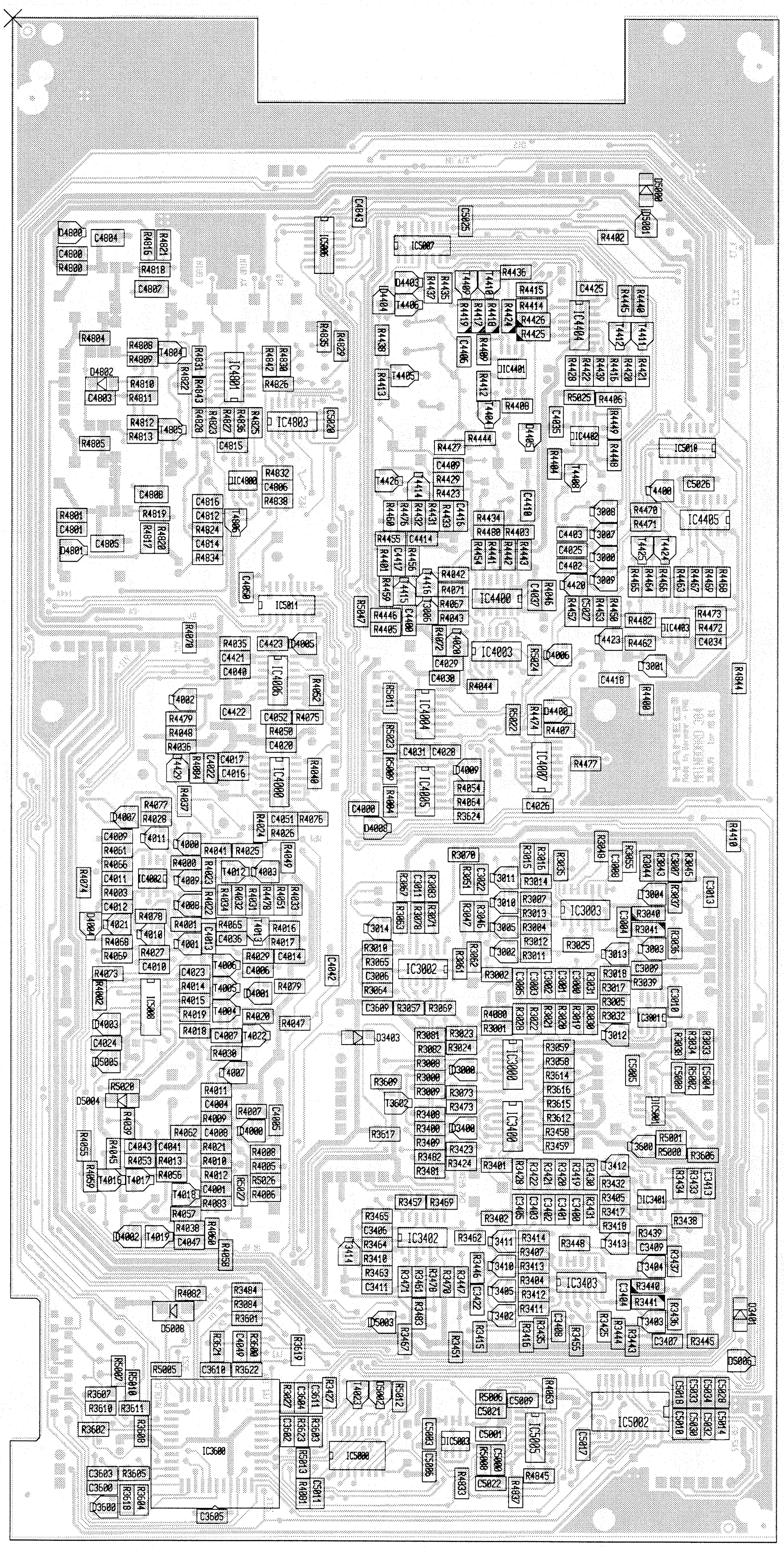

HAMEG
Chemnitz
HM304
Titel: MB304
MB 01
Date: 23.10.95
Sheet: 3 of 6
Document Number: 304.01
SWEEP GENERATOR
HOLDOFF TIMING
SWEEP DELAY
TOP VIEW!
SOT-23
TO-92
SWEEP
SV_DI2
TR-INT
SCS_DA
TIME-VAR
X-CAL
SYS-REF
HOVAR_ON
HOFF_FC
END-DEL
END-HO
DEL-START
ALT-PULS
DIG_SVST
TB_CAL
SV-MODE3
SLOPE
SLOP_DEL
SV-MODE0
SV-MODE2
TR-B-IN
TR-A-IN
SV-MODE1
TV-SEP
IC4001 GAL16V8-15
Änderungen vorbehalten ! Subject to change without notice ! *) if required

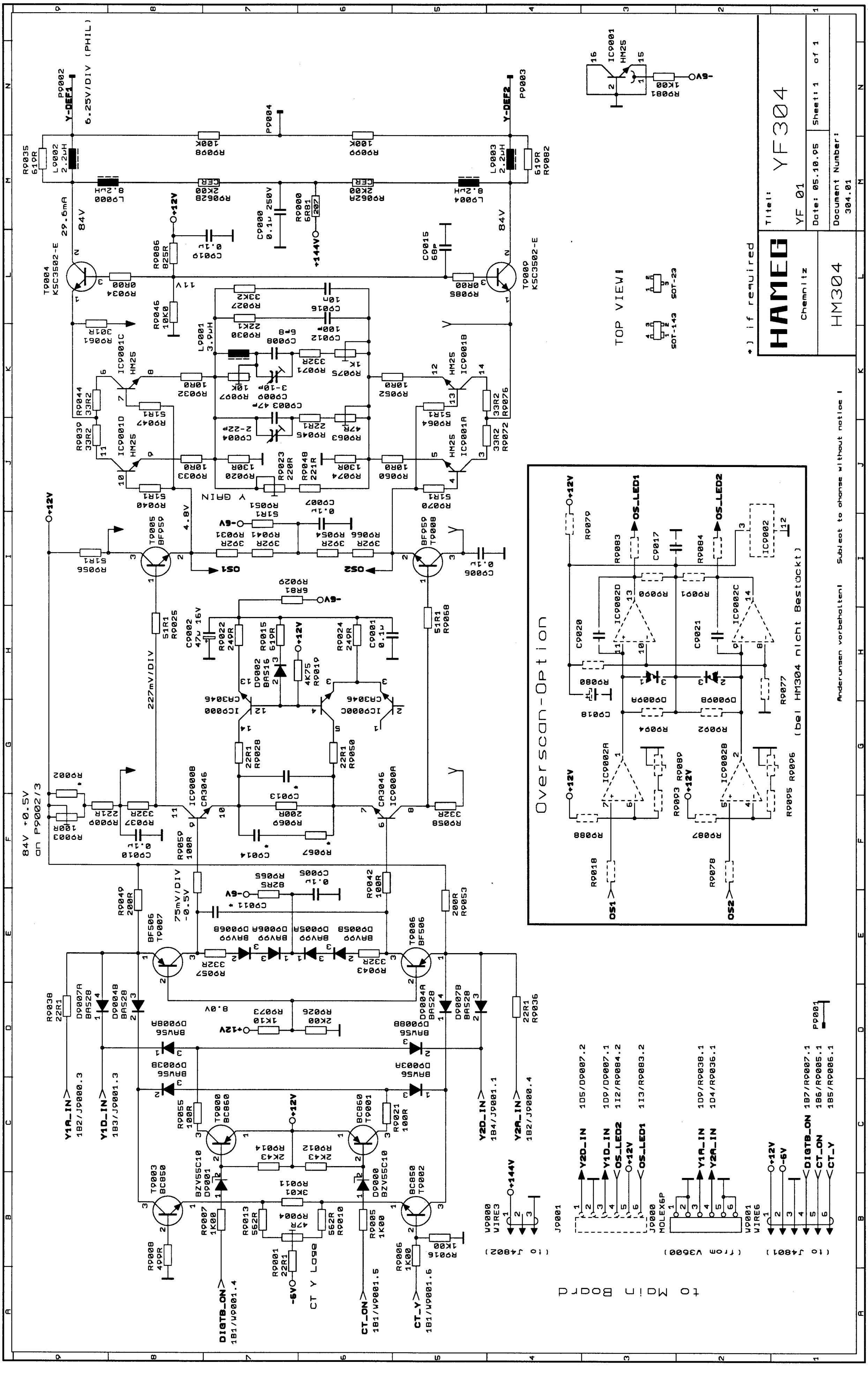

HAMEG
Chemnitz
HM304
Titel: MB304
MB 01
Date: 23.10.95
Sheet: 4 of 6
Document Number: 304.01
DA CONVERTER
AD CONVERTER
TOP VIEW!
SOT-23
TO-92
IC5000 MB88347-PF
IC5002 TLC542CN
IC5006A HEF4094
IC5007A HEF4094
IC5008A HEF4094
IC5010A HEF4094
IC5011A HEF4094
IC5013 LM317LZ
IC5001A TL082CD
IC5001B TL082CD
IC5003A TL082CD
IC5003B TL082CD
IC5005A 74HC4066
IC5005B 74HC4066
J5001 AMP16P
J5002 MOLEX6S
J5004 MOLEX4S
from FC Board (J8000)
from FC Board (V8002)
from FC Board (V8000)
SYS-REF
SYSREF/2
Y1-POS
Y2-POS
POS1_C
POS2_C
POS1-DA
POS2-DA
TR-DA
TIME_VAR
VAR1-DA
VAR2-DA
XPOS_DA
X-CAL
SC_CPU
SCLK
SDO
SDI
SCS_DA
SCS_AD
SCS3_SH
MAIN_CLK
MAIN_SDO
VDD_X
VDD_Y
VSS_X
VSS_Y
+5V_2
12V
-6V
-11V
6V
CS1
CS2
DI2
TR-INT
COUNT-IN
TRGMP
XPOS_OV
HOFF_FC
TB-VAR
TR-LEVEL
XPOS
TB-VAR
TR-LEVEL
HOR_POS
HOLD-OFF
Y1-VAR
Y2-VAR
PP+
PP-
XPDA_ON
SWEEP_ON
DIGTB_ON
MAG_10
X/Y_ON
CT_ON
HO_DEL
HOVAR_ON
DEL÷10
DEL÷100
DEL÷5
DEL÷2
DEL÷1000
HO_OFF
SV-MODE0
SV-MODE3
SLOP_DEL
SLOPE
SV-MODE2
SV-MODE1
TV-FIELD
PP-DIS
TV-SLOP
DC-TRG
HF-C
LINE-ON
LF-TRG
C_SV1
C_SV2
I÷2
I÷5
I÷10
I÷100
TB_CAL
SV_DI2
Änderungen vorbehalten !
Subject to change without notice !
*) if required


HORIZONTAL FINAL AMPLIFIER
HAMEG
Chemnitz
HM304
Titel: MB304
MB 01
Date: 23.10.95
Sheet: 5 of 6
Document Number: 304.01
TOP VIEW!
SOT-23
TO-92
Änderungen vorbehalten ! Subject to change without notice ! *) if required
J4400 MOLEX8S
J4000 MOLEX6S
J4801 MOLEX6S
J4802 MOLEX3S
J5000
J4800 MOLEX6P
from PS Board
from CT Board
from YF Board (W9001)
from YF Board (W9000)
from DS Board
175V
141V
12V
-6V
-11V
LINE-TRG
CT_X
CT_Y
DI2
CT_ON
DIGTB_ON
DIGTB
DIG_SVST
XPOS_OV
XPDA_ON
XPOS_DA
X/Y_ON
SWEEP
SWEEP_ON
X/Y
CT_ON
MAG_10
X GAIN
XY GAIN
X*10
170V
140V
40V
10V
X*1
X*10
T4800 KSC3502-E
T4801 KSC3502-E
T4802 BF472 sel
T4803 BF472 sel
T4804 BF520
T4805 BF520
T4806 BC858
T4807 J310
T4808 J310
IC4801A CA3046
IC4801B CA3046
IC4801C CA3046
IC4800A TL082CD
IC4800B TL082CD
IC4803A 74HEF4066
IC4803B 74HEF4066
IC4803C 74HEF4066
IC4803D 74HEF4066
IC5005C 74HC4066
IC5005D 74HC4066
D4800 BAS16
D4801 BAS16
D4802 BZV55C5V1
L4800 12µH
L4801 12µH

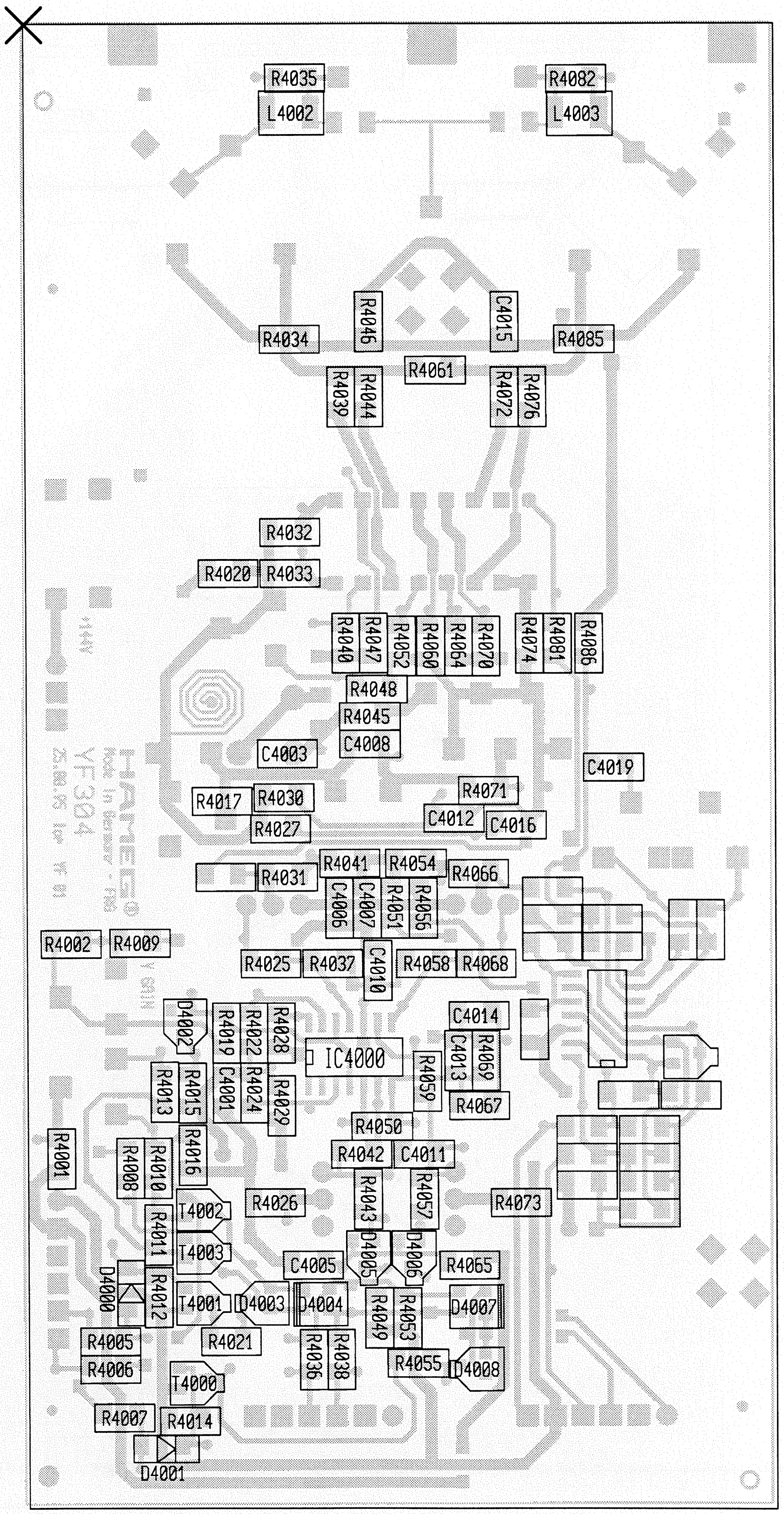

J4802
J4801
C5019
C5024
T4802
R4802
L4800
R4806
R4807
R4841
R4839
R4840
C4809
C4424
C4408
C4427
J4000
J4800
T4800
C4820
C4432
T4808
T4807
C4818
C4819
C4404
T4801
C4811
R4814
R4815
L4801
R4803
C4810
C4817
R4430
T4413
C4411
C4415
T4407
C4405
C4401
T4803
J5000
C5038
C4413
C4813
C4802
C4033
J4400
C4419
T4420
C4412
C4038
IC4001
C4039
C5023
C4021
C4018
C4019
C4027
C4053
C4015
C3012
C3607
R3003
J3001
R3006
C3606
C3608
C5021
C5027
C5007
C4002
W3600
J5004
C4003
J3603
R3613
C5002
T4014
T4015
J3600
R3403
T3410
R3406
C4046
C4044
C4045
R5028
J3401
C3412
C5016
J5001
D5013
C4048
C5015
C5012
C3601
C5013
J3602
C5037
J5002

Main-Board (Bottomside)



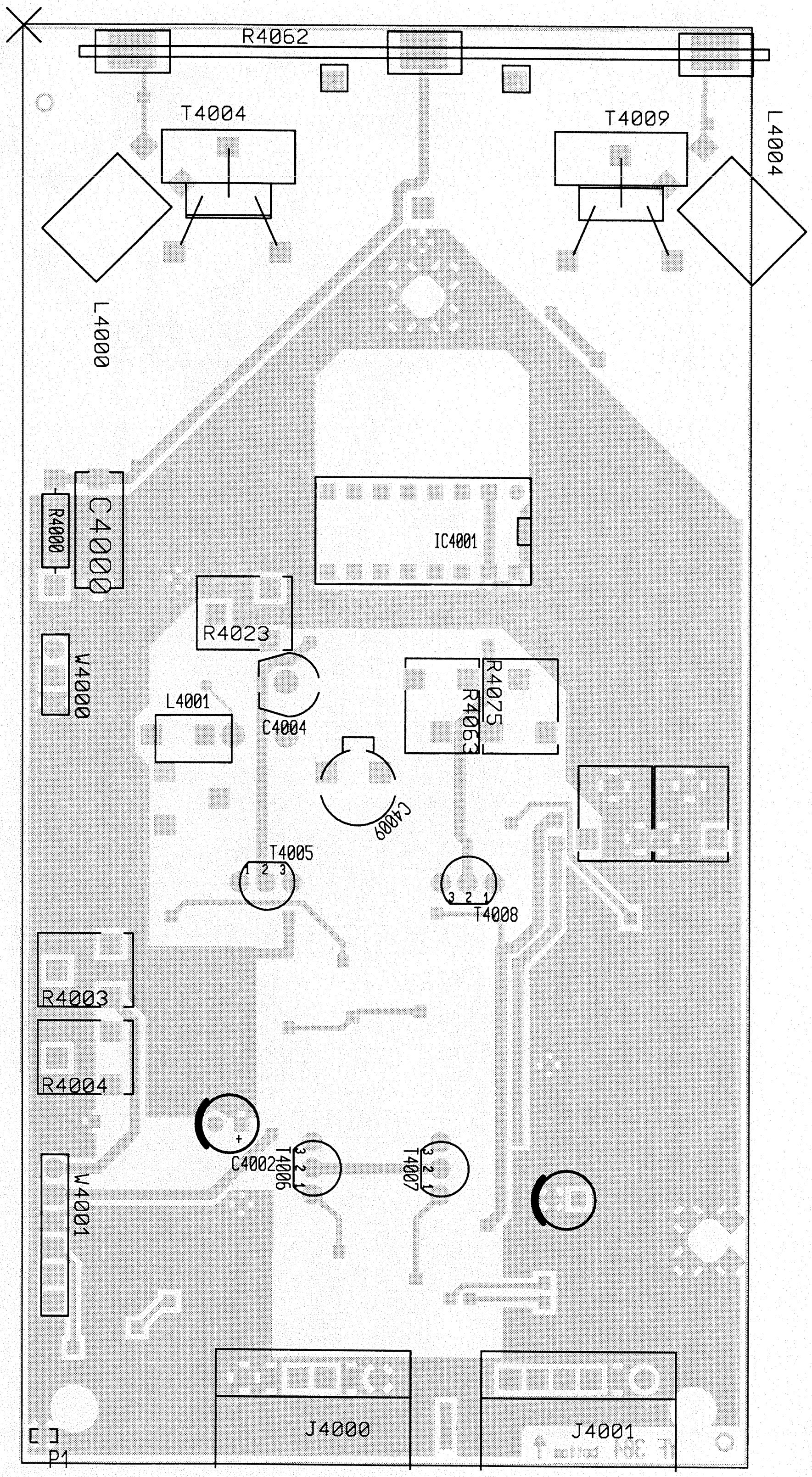

HAMEG
Chemnitz
HM304
Titel: YF304
YF 01
Date: 05.10.95
Sheet: 1 of 1
Document Number: 304.01
*) if required
TOP VIEW!
SOT-143
SOT-23
Y-DEF1
Y-DEF2
6.25V/DIV (PHIL)
Y GAIN
227mV/DIV
75mV/DIV -0.5V
84V +0.5V on P9002/3
OS1
OS2
Overscan-Option
(bei HM304 nicht Bestückt)
OS_LED1
OS_LED2
Y1A_IN
Y1D_IN
Y2D_IN
Y2A_IN
DIGTB_ON
CT_ON
CT_Y
CT Y Lage
to Main Board
(to J4802)
(from V3600)
(to J4801)
Änderungen vorbehalten! Subject to change without notice!

YF-Board (Bottomside)

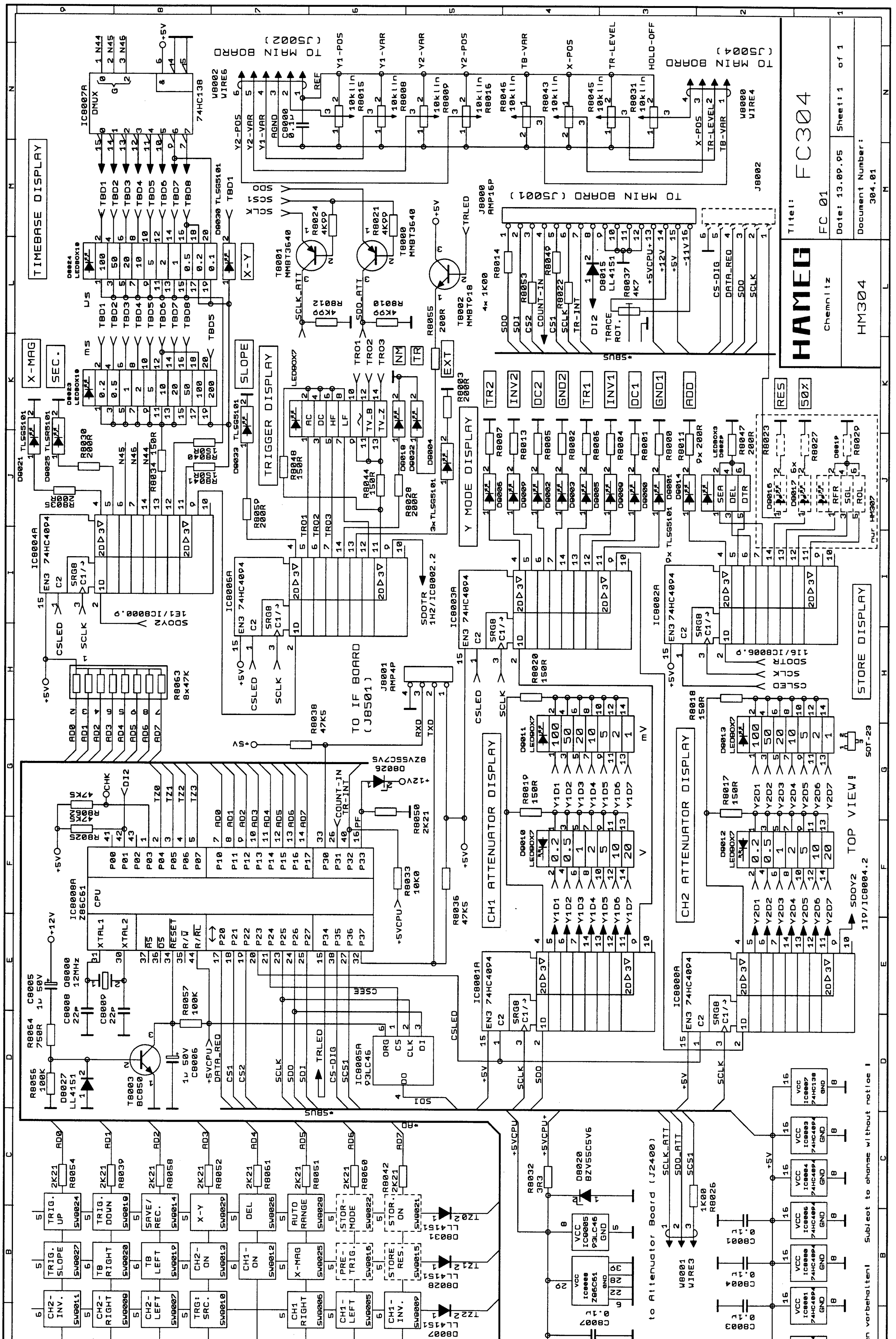

R4035
L4002
R4082
L4003
R4046
C4015
R4034
R4085
R4061
R4039
R4044
R4072
R4076
R4032
R4020
R4033
R4040
R4047
R4052
R4060
R4064
R4070
R4074
R4081
R4086
R4048
R4045
C4008
C4003
C4019
R4071
R4017
R4030
C4012
C4016
R4027
R4041
R4054
R4066
R4031
C4006
C4007
R4051
R4056
R4002
R4009
R4025
R4037
C4010
R4058
R4068
D4002
R4019
R4022
R4028
C4014
IC4000
C4013
R4069
R4013
R4015
C4001
R4024
R4029
R4059
R4067
R4050
R4001
R4008
R4010
R4016
R4042
C4011
R4043
R4057
R4026
R4073
T4002
R4011
T4003
D4005
D4006
C4005
R4065
D4000
R4012
T4001
D4003
D4004
R4049
R4053
D4007
R4005
R4021
R4036
R4038
R4055
D4008
R4006
T4000
R4007
R4014
D4001

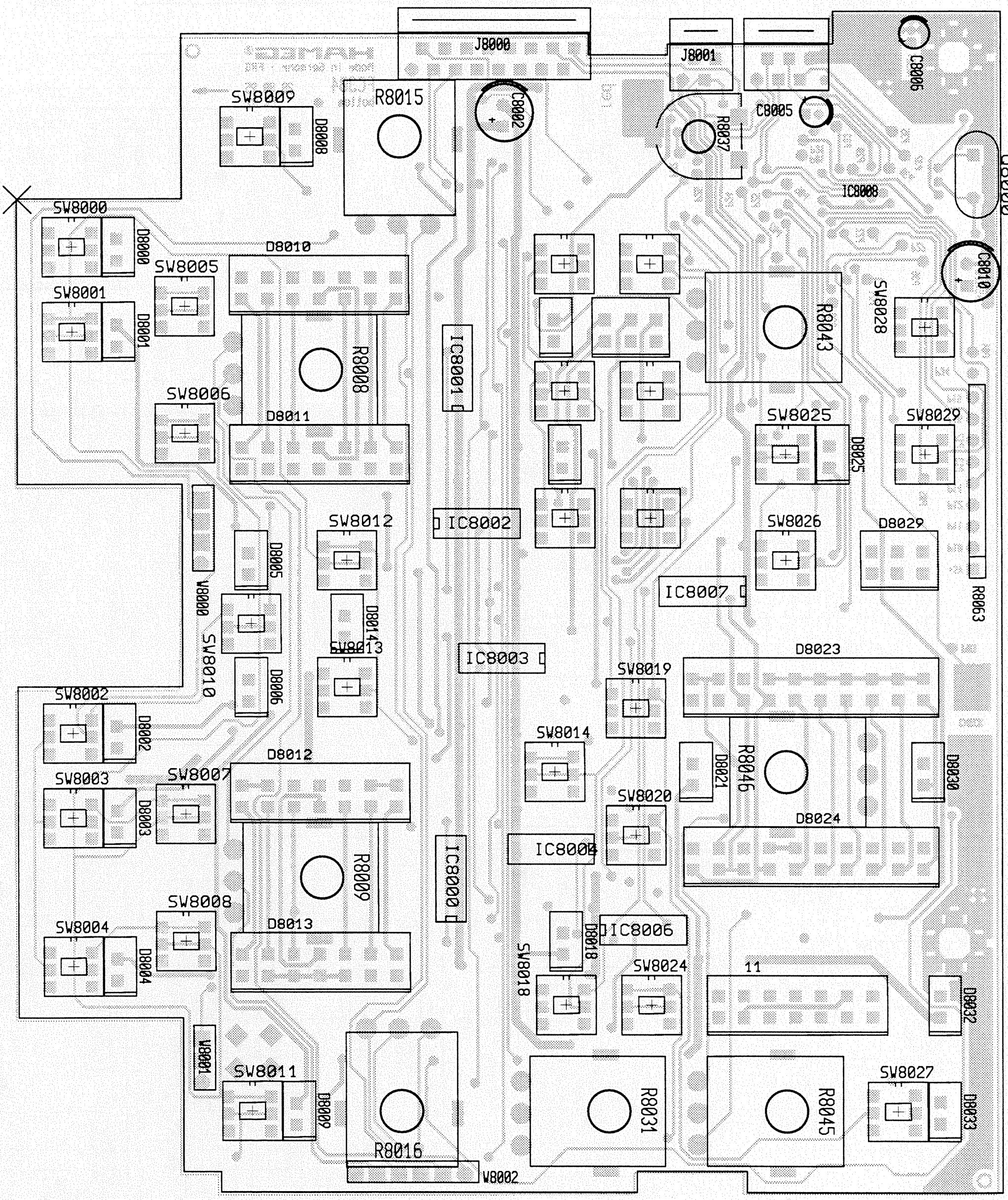
Note: *Components without reference no. are not inserted!*

YF-Board (Topside)

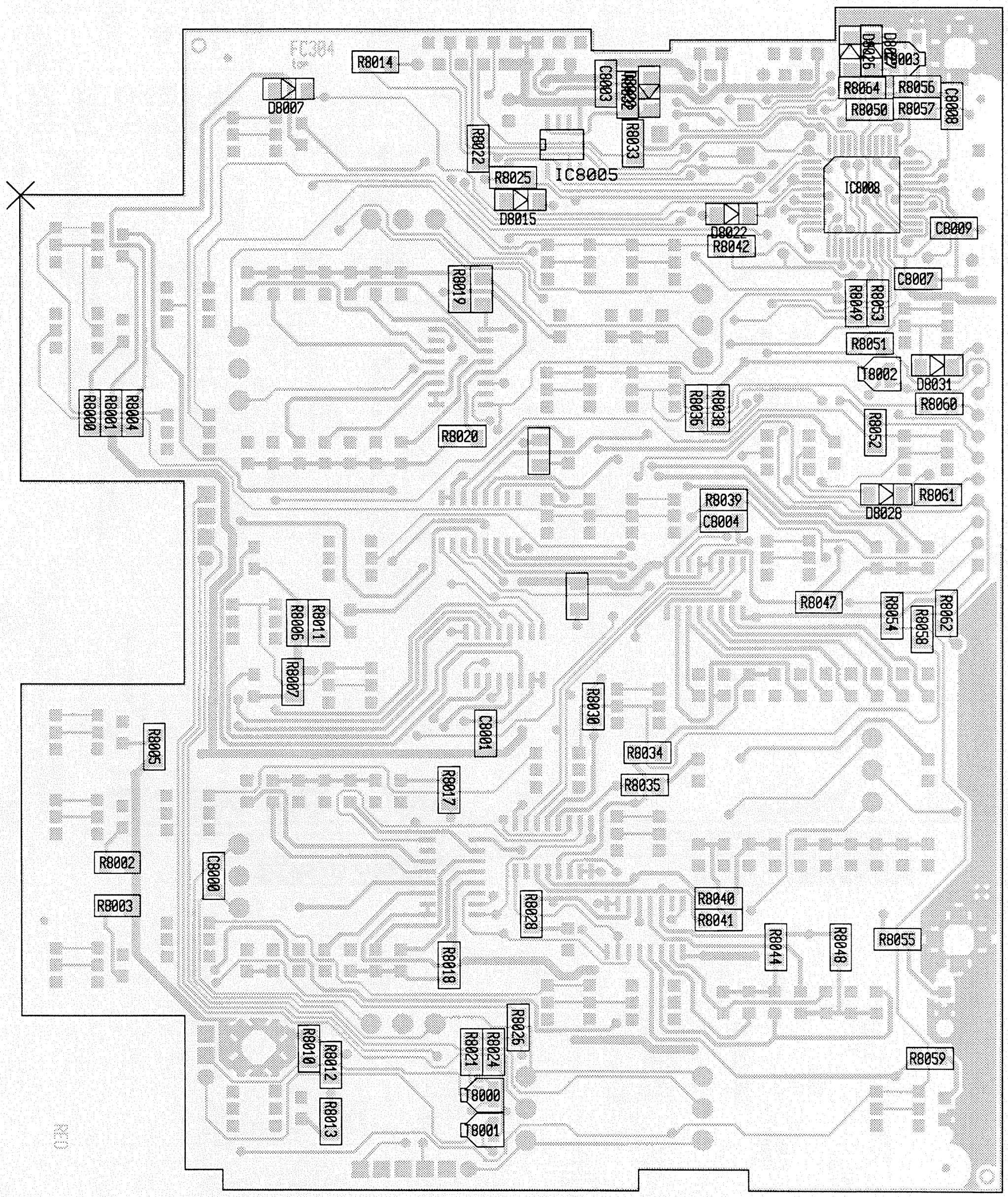

R4062
T4004
T4009
L4004
L4000
R4000
C4000
IC4001
R4023
W4000
L4001
C4004
R4075
R4063
C4009
T4005
T4008
R4003
R4004
C4002
T4006
T4007
W4001
J4000
J4001
P1

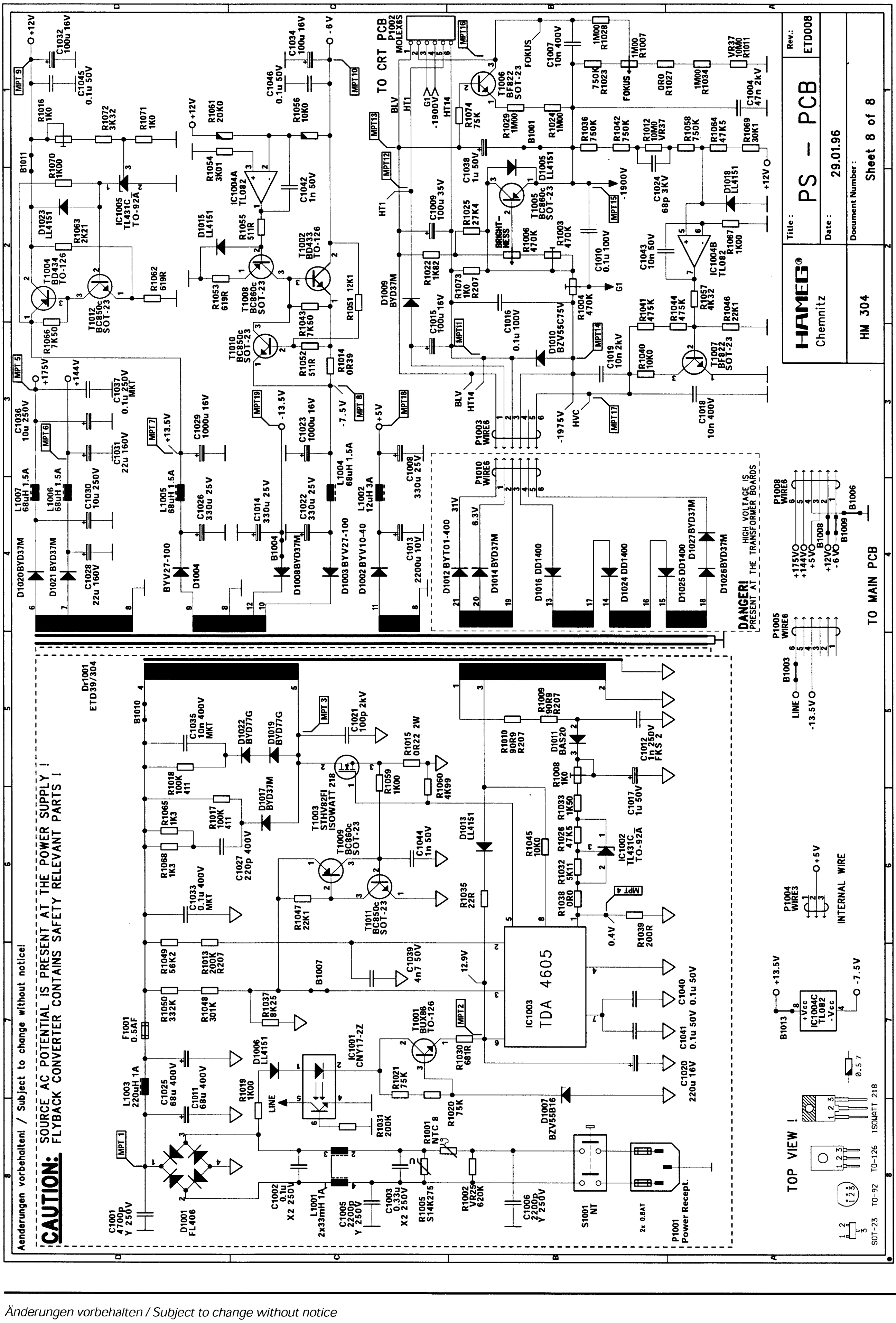
FC-Board


HAMEG
Chemnitz
HM304
Titel: FC304
FC 01
Date: 13.09.95
Sheet: 1 of 1
Document Number: 304.01
TIMEBASE DISPLAY
TRIGGER DISPLAY
Y MODE DISPLAY
CH1 ATTENUATOR DISPLAY
CH2 ATTENUATOR DISPLAY
STORE DISPLAY
TOP VIEW!
TO MAIN BOARD (J5002)
TO MAIN BOARD (J5004)
TO MAIN BOARD (J5001)
TO IF BOARD (J8501)
to Attenuator Board (J2400)
IC8000A Z86C51
IC8007A 74HC138
IC8005A 93LC46
Änderungen vorbehalten! Subject to change without notice !

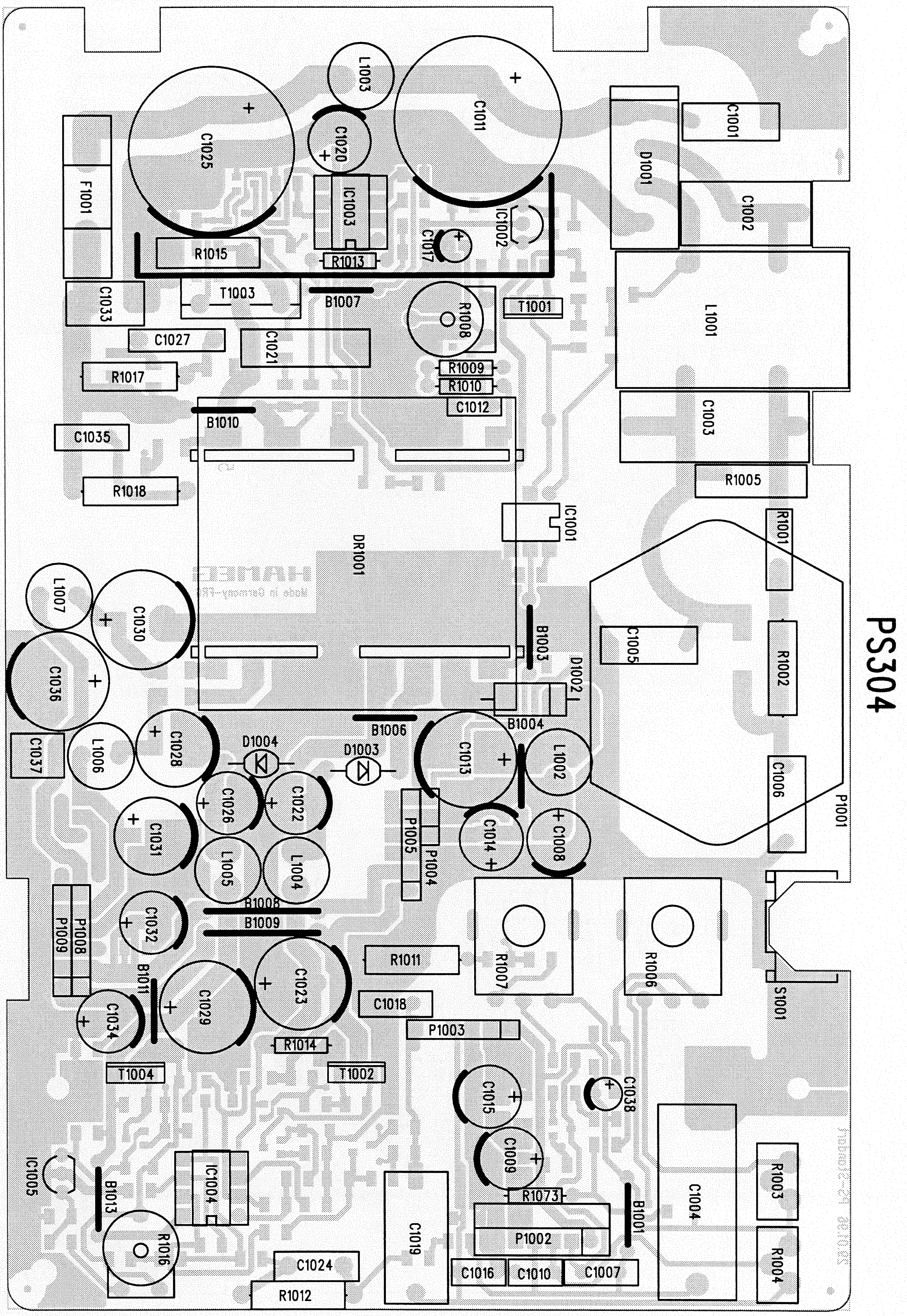

J8000
J8001
C8006
C8005
C8002
R8037
R8015
SW8009
D8008
IC8008
Q8000
C8010
SW8000
D8000
SW8005
D8010
SW8001
D8001
R8008
SW8006
D8011
IC8001
R8043
SW8028
SW8025
D8025
SW8029
SW8012
IC8002
SW8026
D8029
R8063
W8000
D8005
SW8010
D8014
SW8013
D8006
IC8007
IC8003
D8023
SW8019
SW8002
D8002
SW8014
D8021
R8046
D8030
SW8003
D8003
SW8007
D8012
SW8020
D8024
R8009
IC8000
IC8004
SW8008
D8013
SW8004
D8004
D8018
IC8006
SW8018
SW8024
11
D8032
W8001
SW8011
D8009
R8016
R8031
R8045
SW8027
D8033
W8002

FC-Board (Bottomside)


R8014
D8007
C8003
R8032
R8033
R8022
R8025
IC8005
D8015
D8026
D8027
T8003
R8064
R8056
R8050
R8057
C8008
IC8008
D8022
R8042
C8009
C8007
R8049
R8053
R8051
T8002
D8031
R8060
R8019
R8004
R8001
R8000
R8020
R8038
R8036
R8052
R8039
C8004
D8028
R8061
R8047
R8054
R8058
R8062
R8011
R8006
R8007
R8030
R8005
C8001
R8034
R8035
R8017
R8002
C8000
R8003
R8028
R8040
R8041
R8044
R8048
R8055
R8018
R8026
R8010
R8012
R8024
R8021
T8000
T8001
R8013
R8059


Änderungen vorbehalten! / Subject to change without notice!
CAUTION: SOURCE AC POTENTIAL IS PRESENT AT THE POWER SUPPLY !
FLYBACK CONVERTER CONTAINS SAFETY RELEVANT PARTS !
DANGER! HIGH VOLTAGE IS PRESENT AT THE TRANSFORMER BOARDS
TO CRT PCB
TO MAIN PCB
HAMEG®
Chemnitz
HM 304
Title :
PS - PCB
Date :
29.01.96
Document Number :
Sheet 8 of 8
Rev.:
ETD008
Dr1001
ETD39/304
IC1003
TDA 4605
T1003
STHV82FI
ISOWATT 218
IC1001
CNY17-2Z
T1001
BUX86
TO-126
F1001
0.5AF
L1003
220uH 1A
D1001
FL406
L1001
2x33mH 1A
R1001
NTC 8
R1005
S14K275
S1001
NT
P1001
Power Recept.
2x 0.8AT
P1002
MOLEX6S
P1003
WIRE6
P1010
WIRE6
P1005
WIRE6
P1008
WIRE6
P1004
WIRE3
INTERNAL WIRE
IC1004C
TL082
+Vcc
-Vcc
IC1004A
TL082
IC1004B
TL082
IC1005
TL431C
TO-92A
IC1002
TL431C
TO-92A
T1004
BD434
TO-126
T1002
BD433
TO-126
T1006
BF822
SOT-23
T1007
BF822
SOT-23
T1005
BC860c
SOT-23
BRIGHT-NESS
FOKUS
G1
-1900V
HT1
HT14
BLV
HVC
-1975V
+12V
-6V
+175V
+144V
+13.5V
-13.5V
-7.5V
+5V
LINE
0.4V
12.9V
TOP VIEW !
SOT-23
TO-92
TO-126
ISOWATT 218

Power Supply (Topside)


PS304
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L1003
C1020
C1011
C1001
D1001
C1002
F1001
IC1003
IC1002
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R1015
R1013
C1033
T1003
B1007
R1008
T1001
L1001
C1027
C1021
R1009
R1010
R1017
C1012
B1010
C1003
C1035
R1005
R1018
IC1001
R1001
DR1001
L1007
C1030
C1036
B1003
C1005
R1002
D1002
B1004
B1006
C1037
L1006
C1028
D1004
D1003
C1013
L1002
C1006
P1001
C1026
C1022
C1031
C1014
C1008
P1005
P1004
L1005
L1004
B1008
B1009
P1008
P1009
C1032
R1011
R1007
R1006
S1001
B1011
C1029
C1023
C1034
C1018
P1003
R1014
T1004
T1002
C1015
C1038
C1009
IC1005
B1013
IC1004
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C1004
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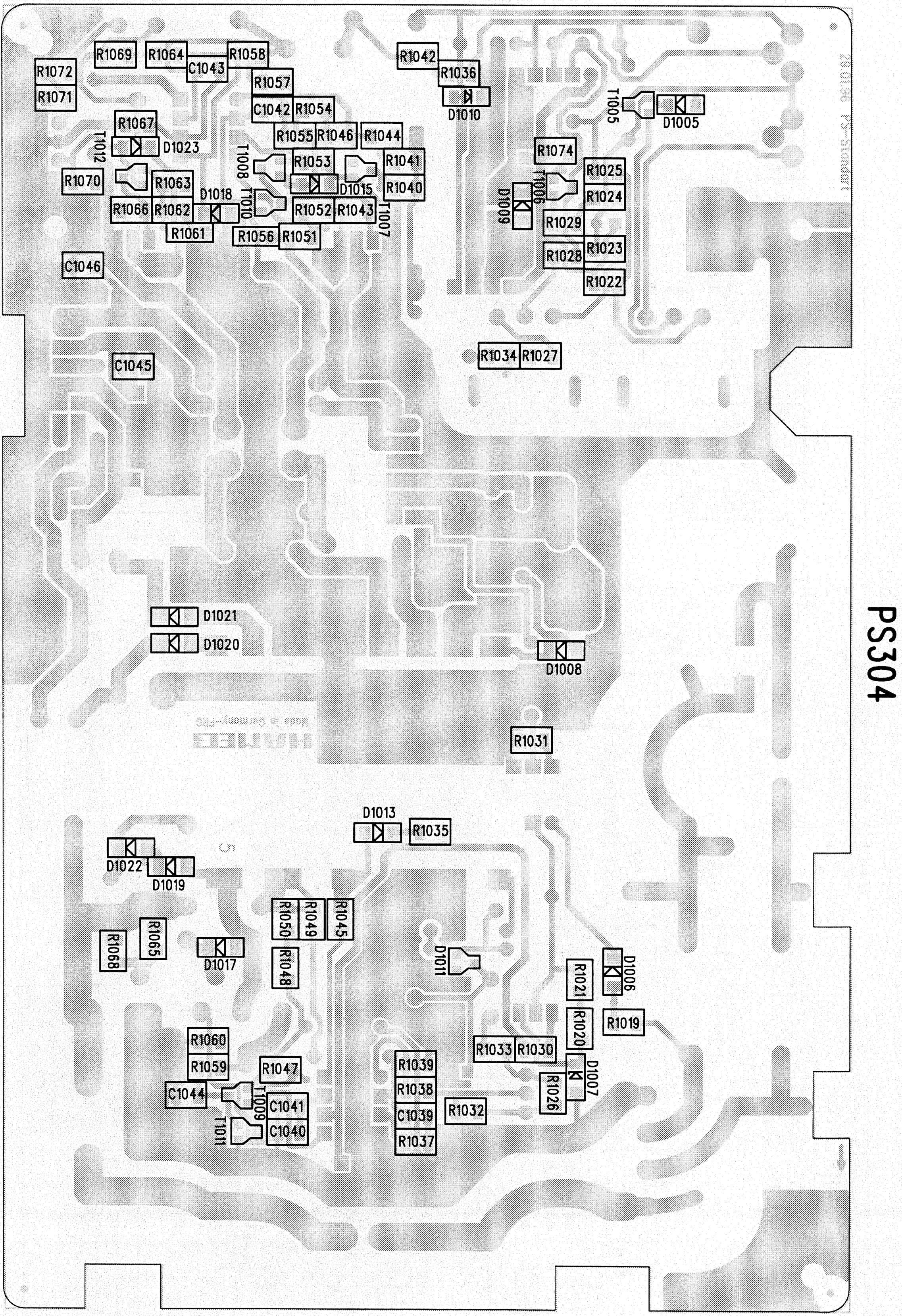
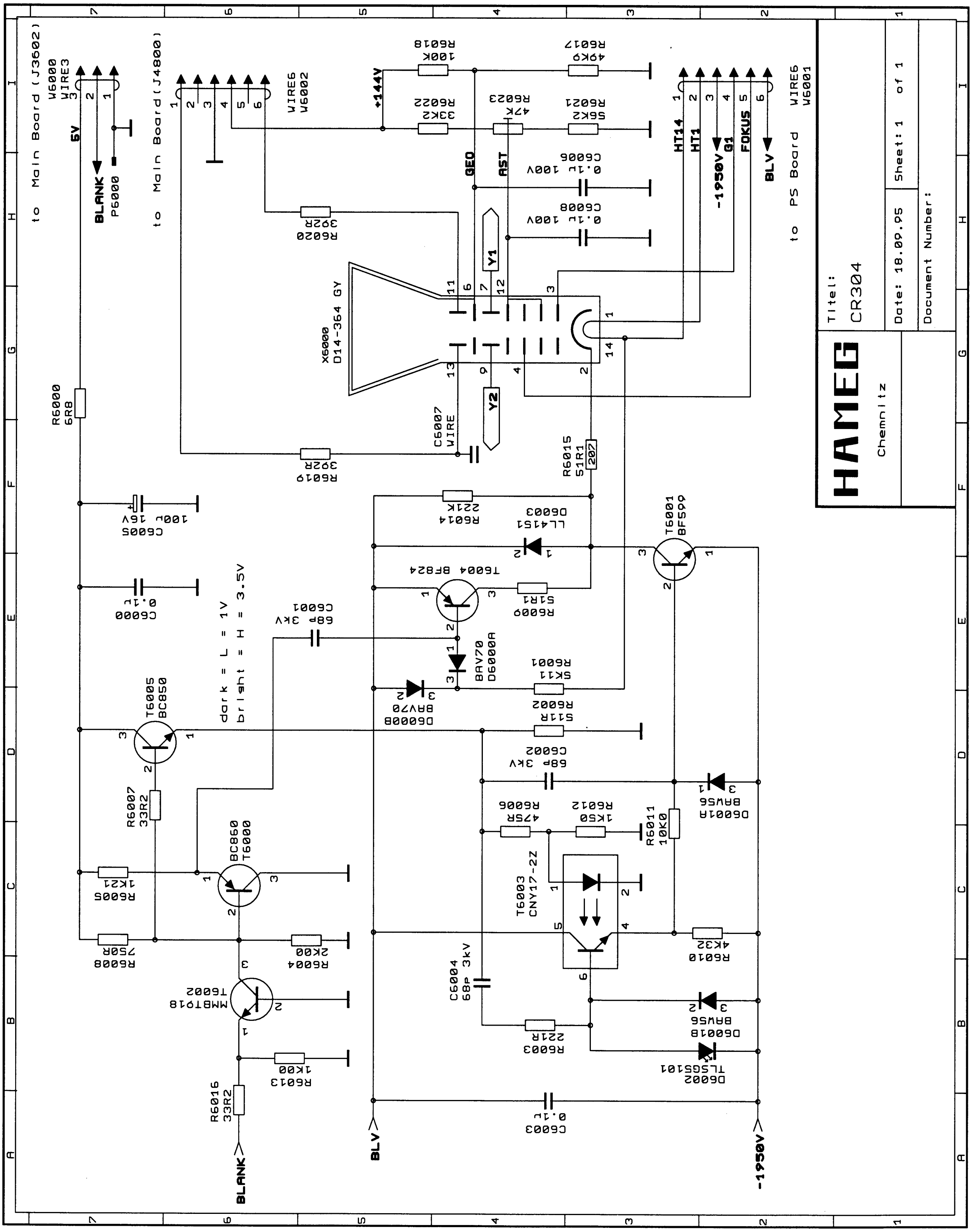
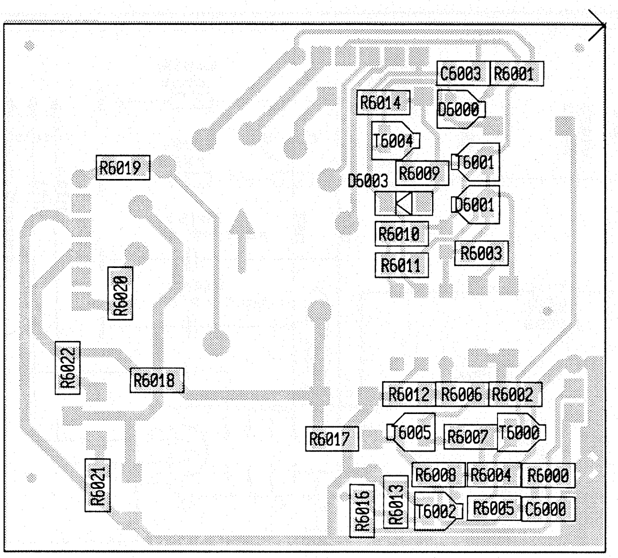
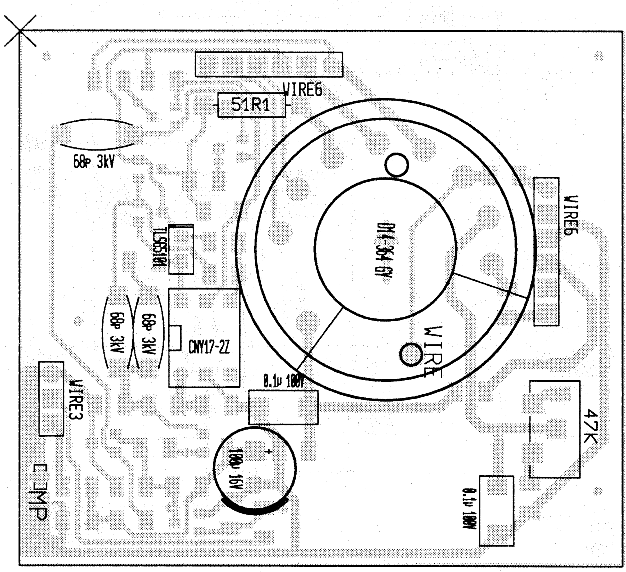
P1002
R1016
C1024
C1016
C1010
C1007
R1004
R1012

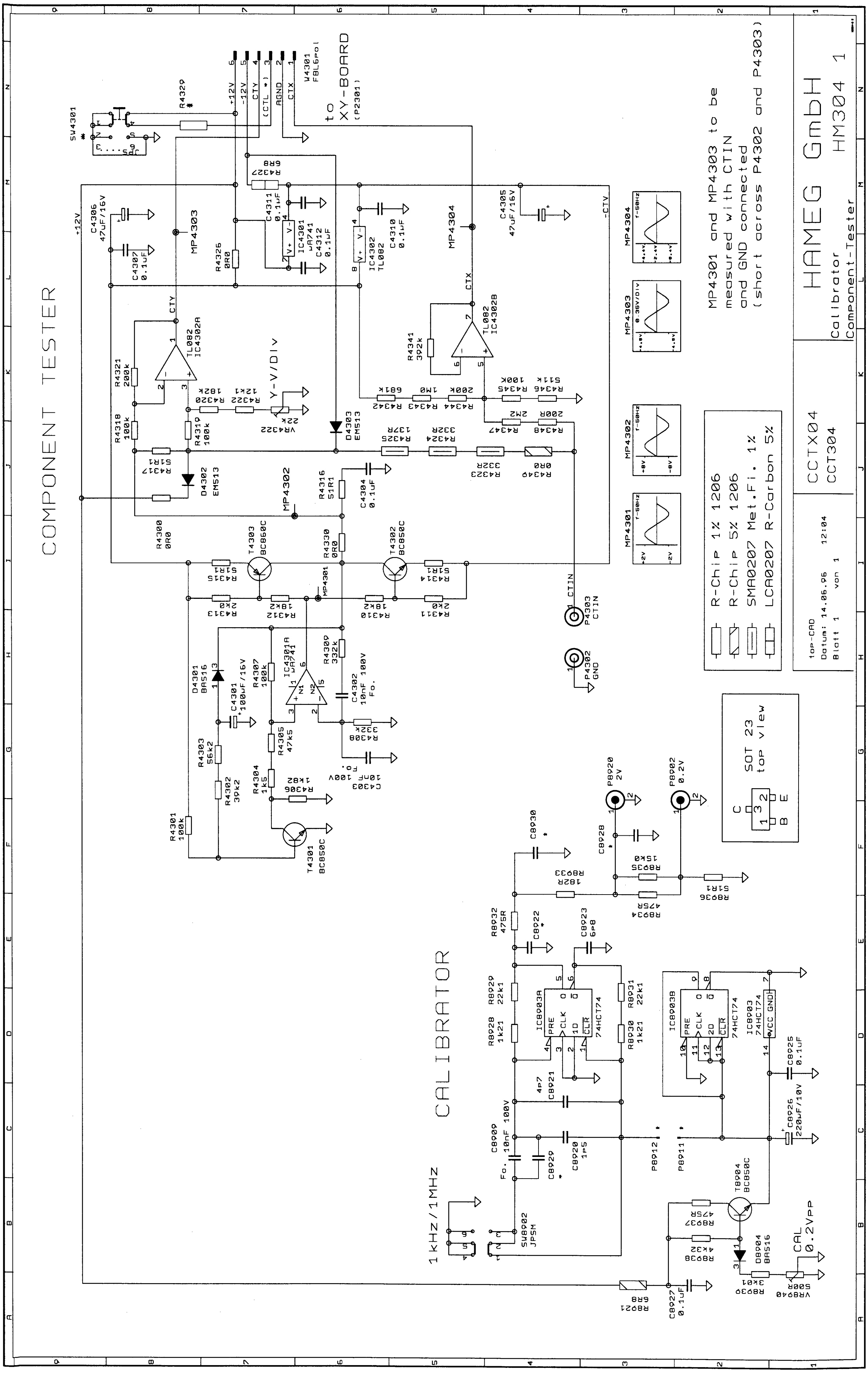

R1072
R1071
R1069
R1064
C1043
R1058
R1057
C1042
R1054
R1067
D1023
T1012
R1070
R1063
R1066
R1062
D1018
R1061
T1008
T1010
R1055
R1046
R1044
R1053
D1015
R1041
R1040
R1052
R1043
T1007
R1056
R1051
C1046
C1045
R1042
R1036
D1010
T1005
D1005
R1074
T1006
D1009
R1025
R1024
R1029
R1028
R1023
R1022
R1034
R1027
D1021
D1020
D1008
R1031
Made in Germany-FRG
HAMEG
D1013
R1035
D1022
D1019
R1068
R1065
D1017
R1050
R1049
R1045
R1048
D1011
R1021
D1006
R1020
R1019
R1060
R1059
R1047
C1044
T1009
T1011
C1041
C1040
R1039
R1038
C1039
R1037
R1032
R1033
R1030
R1026
D1007
PS304

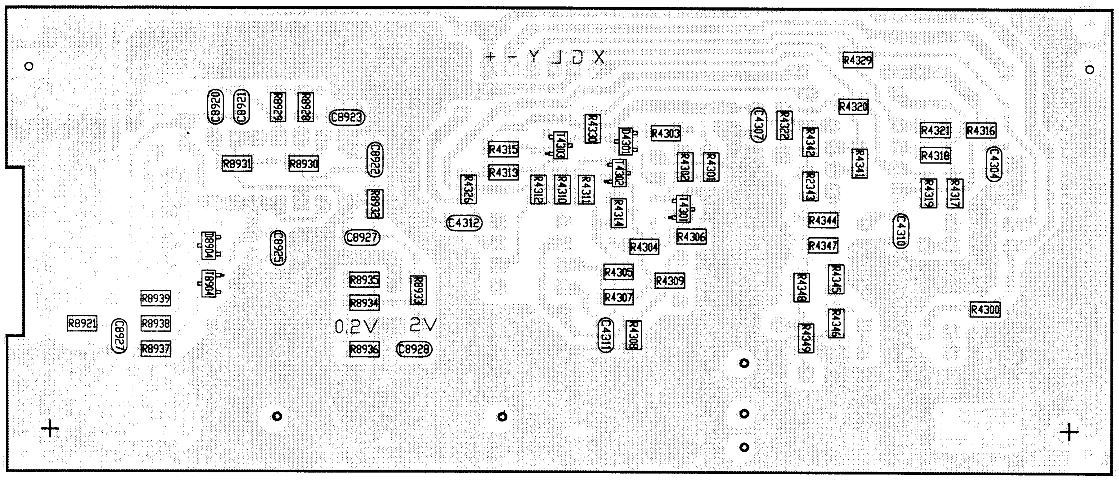
Änderungen vorbehalten / Subject to change without notice

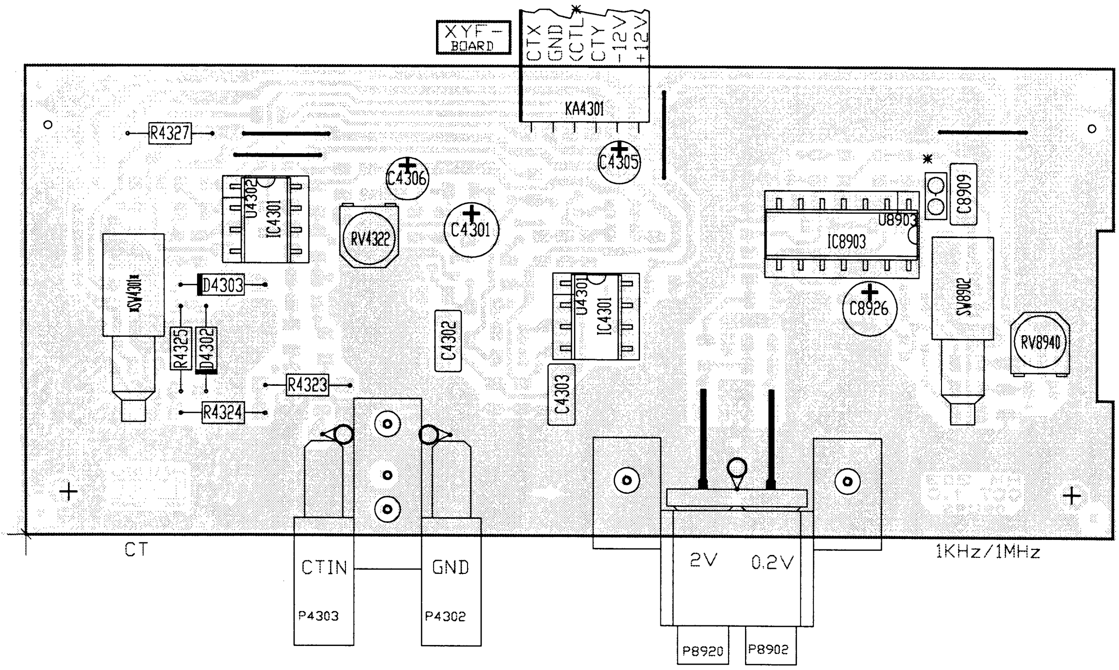

HAMEG
Chemnitz
Titel: CR304
Date: 18.09.95
Sheet: 1 of 1
Document Number:
to Main Board (J3602)
W6000 WIRE3
to Main Board (J4800)
WIRE6 W6002
to PS Board
WIRE6 W6001
5V
BLANK P6000
+144V
GEO
AST
HT14
HT1
-1950V
G1
FOKUS
BLV
X6000 D14-364 GY
Y1
Y2
R6018 100K
R6017 49K9
R6022 33K2
R6023 47K
R6021 56K2
C6006 0.1µ 100V
C6008 0.1µ 100V
R6020 392R
R6019 392R
C6007 WIRE
R6000 6R8
R6015 51R1
C6005 100µ 16V
C6000 0.1µ
R6014 221K
D6003 LL4151
T6004 BF824
R6009 51R1
T6001 BF599
C6001 68P 3KV
BAV70 D6000A
R6001 5K11
D6000B BAV70
R6002 511R
dark = L = 1V
bright = H = 3.5V
T6005 BC850
C6002 68P 3KV
R6007 33R2
R6006 475R
R6012 1K50
R6011 10K0
D6001A BAW56
T6000 BC860
R6005 1K21
T6003 CNY17-2Z
R6008 750R
R6004 2K00
C6004 68P 3kV
R6010 4K32
T6002 MMBT918
D6001B BAW56
R6003 221R
R6013 1K00
D6002 TLSG5101
R6016 33R2
C6003 0.1µ
BLANK
BLV
-1950V
A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7

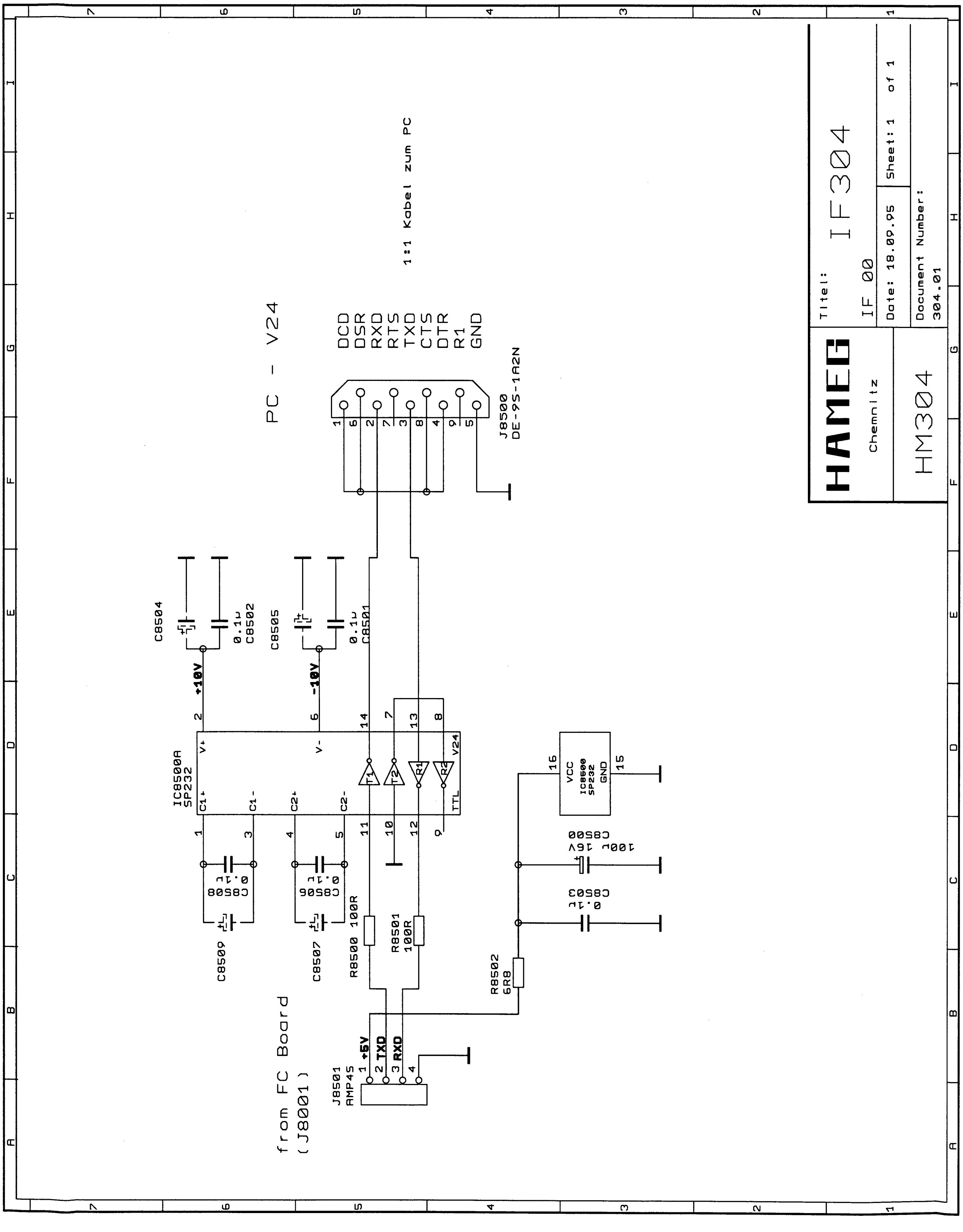

C6003
R6001
R6014
D6000
T6004
R6009
T6001
D6003
D6001
R6019
R6010
R6003
R6011
R6020
R6022
R6018
R6012
R6006
R6002
R6017
T6005
R6007
T6000
R6008
R6004
R6000
R6021
R6016
R6013
T6002
R6005
C6000


WIRE6
51R1
68p 3kV
TL5651
DM4-364 GY
WIRE6
68p 3kV
68p 3kV
CNY17-2Z
WIRE
0.1µ 100V
WIRE3
47K
100µ 16V
JMP
0.1µ 100V

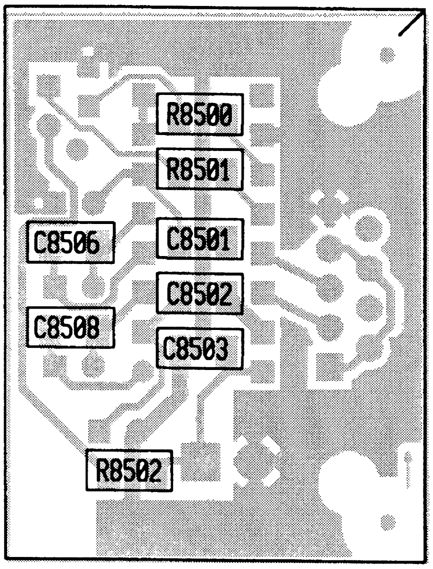

COMPONENT TESTER
CALIBRATOR
to XY-BOARD (P2301)
V4301 FBL6pol
+12V
-12V
CTY
(CTL •)
AGND
CTX
-CTV
Y-V/DIV
CTIN
GND
P4302
P4303
MP4301
MP4302
MP4303
MP4304
IC4301 μA741
IC4302 TL082
IC4301A μA741
IC4302A TL082
IC4302B TL082
T4301 BC850C
T4302 BC850C
T4303 BC850C
D4301 BAS16
D4302 EM513
D4303 EM513
IC8903A 74HCT74
IC8903B 74HCT74
IC8903 74HCT74
T8904 BC850C
D8904 BAS16
SW8902 JPSM
1kHz/1MHz
CAL 0.2Vpp
P8920 2V
P8902 0.2V
P8911
P8912
MP4301 and MP4303 to be measured with CTIN and GND connected (short across P4302 and P4303)
R-Chip 1% 1206
R-Chip 5% 1206
SMA0207 Met.Fi. 1%
LCA0207 R-Carbon 5%
SOT 23 top view
C
B
E
HAMEG GmbH
HM304 1
Calibrator
Component-Tester
CCTX04
CCT304
top-CAD
Datum: 14.06.96 12:04
Blatt 1 von 1

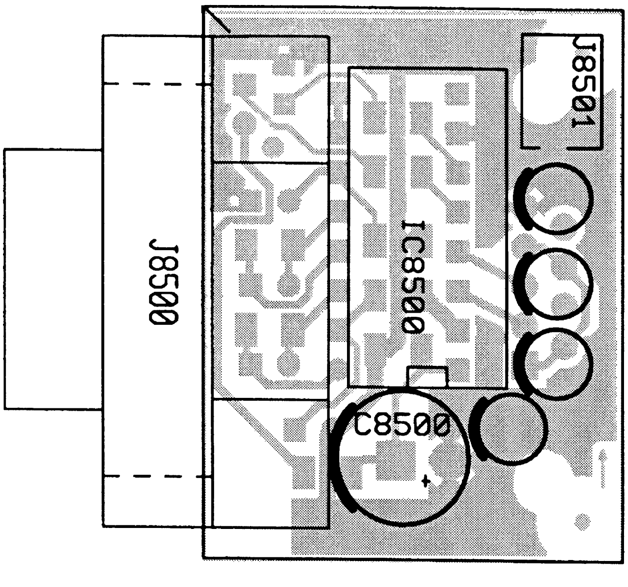

+ - Y ⅃ Ɑ X
R4329
C8920
C8921
R8929
R8928
C8923
R4320
C4307
R4322
R4321
R4316
R4315
R4330
R4303
R4342
R8931
R8930
C8922
R4313
R4302
R4301
R4341
R4318
C4304
R4326
R4312
R4310
R4311
R4314
R8932
R2343
R4319
R4317
C4312
R4306
R4344
C4310
C8927
R4304
R4347
C8925
R4305
R4309
R4348
R4345
R8935
R8933
R8934
R4307
R8939
R8921
R8938
C8924
R4300
0.2V
2V
C4311
R4308
R4346
R4349
R8937
R8936
C8928
+
+


XYF-
BOARD
CTX
GND
XCTL
CTY
-12V
+12V
KA4301
R4327
C4306
C4305
U4302
IC4301
RV4322
C4301
C8909
IC8903
U8903
SV4301
D4303
U4301
IC4301
C8926
SV8902
R4325
D4302
C4302
RV8940
R4323
C4303
R4324
+
+
CT
CTIN
GND
P4303
P4302
2V
0.2V
P8920
P8902
1KHz/1MHz


HAMEG
Chemnitz
Titel:
IF304
IF 00
Date: 18.09.95
Sheet: 1 of 1
Document Number:
304.01
HM304
PC - V24
1:1 Kabel zum PC
DCD
DSR
RXD
RTS
TXD
CTS
DTR
R1
GND
J8500
DE-9S-1A2N
C8504
0.1u
C8502
C8505
0.1u
C8501
+10V
-10V
IC8500A
SP232
V+
V-
C1+
C1-
C2+
C2-
T1
T2
R1
R2
V24
TTL
VCC
IC8500
SP232
GND
100u 16V
C8500
0.1u
C8503
R8502
6R8
C8508
0.1u
C8506
0.1u
C8509
C8507
R8500 100R
R8501
100R
J8501
AMP45
+5V
TXD
RXD
from FC Board
(J8001)

IF-Board (Bottomside and Topside)


R8500
R8501
C8506
C8501
C8502
C8508
C8503
R8502


J8501
J8500
IC8500
C8500
+

Block Diagram

Adjustment Procedure

ADJUSTMENT PROCEDURE

35MHz Analog-Oscilloscpe HM304

WARNING

The Instrument must be disconnected from the mains power supply whenever you open the case, repair or exchange parts.

HIGH VOLTAGE WARNING!

Hazardous High Voltage of up to 2,000 Volts is present inside this Instrument. The areas particularly affected by High Voltage are the high voltage circuit on the PS-board, the CRT-board and the CRT-socket.

SERVICE AND ADJUSTMENT

- of this instrument should only be performed in accordance and in conjunction with the operating manual and the WARNINGS contained therein.

- should only be performed by suitable qualified and experienced service personnel, or should be referred to one of the HAMEG companies listed on the rear cover of the manual.

Test Instruments required:

1) Scope Tester HZ 60-2.
2) Constant amplitude sinewave generator, 20Hz - 250MHz, output 5mV - 5V into 50Ω, preferably with 20dB attenuation (e.g. HM 8133, TEK SG502 + TEK SG503).
3) Amplitude Calibrator with 1kHz square wave output and 600Ω impedance, risetime faster than 150ns. Output voltage 2mV - 20Volts in 1-2-5 sequence for 4 divisions display amplitude (e.g. HZ62, TEK PG506).
4) Time mark generator from 5ns/div to 5s/div. Output min. 10mV into 50Ω (e.g. HZ62, TEK TG501).
5) Pre-attenuator 2:1 (1 MΩ parallel with 12-48pF), e.g. HZ20.
6) 50Ω BNC through termination, e.g. HZ22.
7) 2 BNC-cables, 50Ω, e.g. HZ34.
8) BNC-T-connector.
9) Oscilloscope probe 10:1, with exactly 9MΩ series resistance and compensated for test oscilloscope mentioned under 10).
10) Oscilloscope 100MHz, 5mV/div to 5V/div, e.g. HM1005.
11) Trimming/adjusting tool.
12) Variable output safety insulation transformer.
13) Video signal generator with positive and negative signal output.

This procedure covers all adjustments and the most important - but not all - performance checks. The correct sequence of all adjustment steps must be strictly followed.

Exact adjustment is only possible when any influence of the earths' magnetic field has been compensated with the trimmer marked TR (trace rotation).

All adjustments should only be performed by qualified and experienced personnel. This is particularly important for adjustments in the high voltage section of the instrument.

1) R1008: +144 Volt supply. 35
2) R1016: +12 Volt supply. 35
3) VR7000: Trace Rotation Check. 35
4) R1004 : CRT minimum intensity. 35
5) R1003 : CRT maximum intensity. 35
6) R4003: Mean Y-plate Potential. 35
7) R6023 : Astigmatism correction. 35
8) R4023: Y-Gain CH I. 37
9) R2189: FET operating point CH I. 37
10) R2141: Invert-Balance CH I. 37
11) R2131: Variable-Balance CH I. 37
12) R2000: 10Hz Squarewave 5mV/div CH I. 37
13) R2002: 10Hz Squarewave 1mV/div Adjustment CH I. 37
14) R3403: Y-Gain CH II. 39
15) R2389: FET operating point CH II. 39
16) R2341: Invert-Balance CH II. 39
17) R2226: Variable-Balance CH II. 39
18) R2200: 10Hz Squarewave 5mV/div CH II. 39
19) R2202: 10Hz Squarewave 1mV/div CH II. 39
20) R4075 (A), R4063 (C), C4009 (B) and C4004 (D): 39
21) Y-Amplifier Bandwidth Check. 41
22) C2009/2013/2007/2012: Attenuator Compensation CH I. 41
23) C2209/2213/2207/2212: Attenuator Compensation CH II. 41
24) R3613: ADDition/Offset. 43
25) R4430: Sweep Start Position. 43
26) R4841: X-Gain x1. 43
27) C4411: Sawtooth Start Linearity. 43
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NOTE

The adjustment procedures assume that the instrument had once been properly adjusted in the factory and adjustments are required due to temperature drift or the replacement of defective components.

Before starting each adjustment procedure, set the oscilloscope to the following basic settings:

X-Section:

TIME/DIV.	0.1µs
TIME VAR.	calibrated detent (fully cw)
NORM (trigger)	off
TRIG. (coupling)	AC
TRIG. LEVEL	mechanical center position
TRIG. (SLOPE)	+ (- LED dark)
HOLD OFF	x1
XY	off
X-POS.	mechanical center position
X-MAG. x10	off
DELAY (mode)	off

Y-Section:

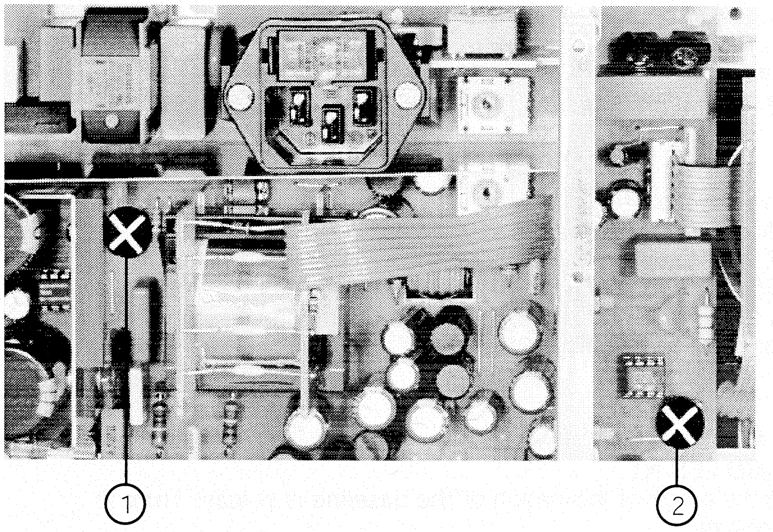
CH I	on, 5mV/div, calibrated, DC input coupling
CH II	off, 5mV/div, calibrated, DC input coupling
INV CH I & II	off
Y-POS I & II	mechanical center position
EXTern (trigger)	off

COMP. TESTER & CAL-Section

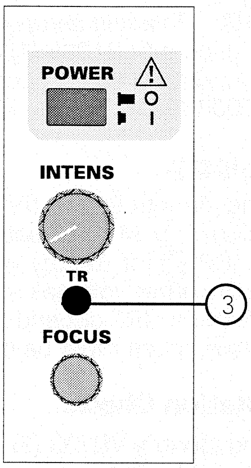
COMPONENT TESTER	off
CALIBRATOR	1 kHz

If different settings are required, they are mentioned particularly for each subject.

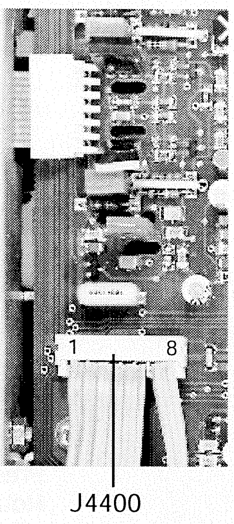
PS-Board



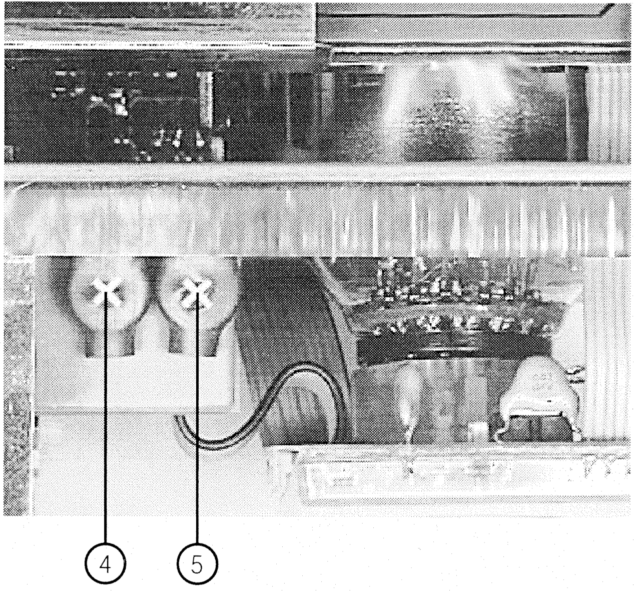
FC-Board HM304


POWER
O
I
INTENS
TR
FOCUS
3

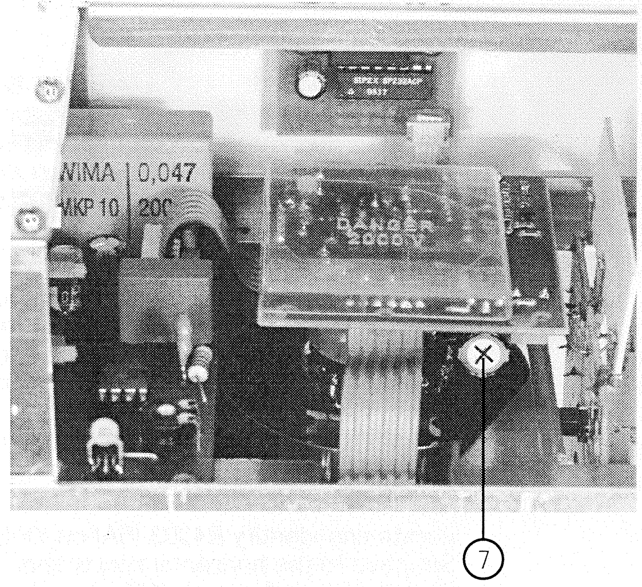
MB-Board



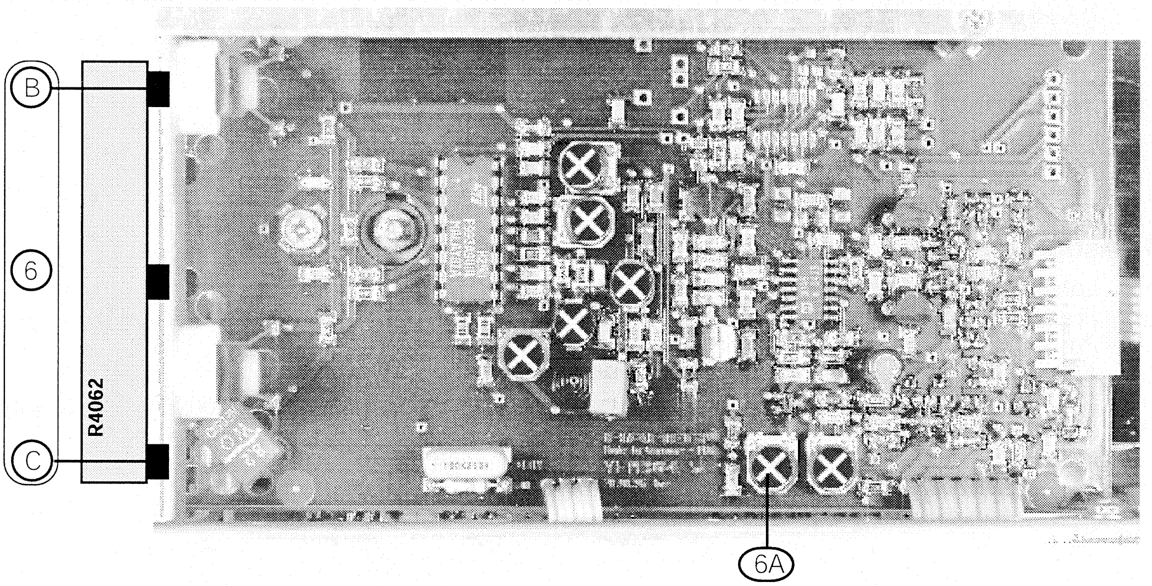
PS-Board (Top side)



CRT-Board (Bottom side)


WIMA 0,047
MKP 10 200
DANGER 2000V
7

YF-Board


B
6
R4062
C
6A

1) R1008: +144 Volt supply.

WARNING: *To avoid damage use a fully insulated screwdriver!*

Locate and identify R1008 (1) on PS-Board (screened section).

Locate connector J4400 (8pole Molex) on MB-Board and identify pin 2.

Adjust R1008 (1) for exactly +144 Volts (± 0.1 Volt) at J4400 pin 2 with respect to chassis.

2) R1016: +12 Volt supply.

Locate and identify R1016 (2) on PS-Board.

Locate connector J4400 (8pole Molex) on MB-Board and identify pin 5.

Adjust R1016 (2) for exactly +12 Volts (± 10mV) at J4400 pin 5 with respect to chassis.

At J4400 the other voltages +175V (pin 1), -11V (pin 7), +5V (pin 4), -6V (pin 6) and -1950V on cathode of CRT depend on the correct +12 Volt adjustment. All these voltages with higher tolerances must be checked and verified.

3) VR7000: Trace Rotation Check.

Locate and identify VR703 (3) „TR" on the front panel.

Press channel I GD pushbutton (GD LED lit).

Rotate VR703 (3) and check that the range of inclination of the baseline is at least 1mm at both horizontal limits of the graticule.

Readjust baseline exactly parallel to the horizontal center line of the graticule.

Press channel I GD pushbutton (GD LED dark).

4) R1004 : CRT minimum intensity.

Locate and identify R1004 (4) on PS-Board.

Set INTENS. control to fully left position.

Press XY pushbutton for XY mode (XY LED lit).

Adjust R1004 (4) so that the dot just disappears.

Press XY pushbutton for time base mode (XY LED dark).

5) R1003 : CRT maximum intensity.

Locate and identify R1003 (5) on PS-Board.

Set INTENS. control to fully right position.

Set FOCUS knob on the front panel for optimum sharpness.

Adjust R1003 (5) so that the beam diameter is 1.5mm.

Repeat adjustment 4 and 5 until optimum is obtained!

6) R4003: Mean Y-plate Potential.

Locate and identify R4003 (6A) on YF-Board.

Set trace to the horizontal center line.

Switch the oscilloscope OFF.

Locate and identify the ceramic (double) resistor R4062 A and B with the connections 6B and 6C.

Connect 6B and 6C (short) galvanically (wire with crocodile clips).

Switch the oscilloscope ON.

Measure the DC voltage at 6B or 6C with respect to ground.

Adjust R4003 (6A) for +84Volt (± 0.5V).

Switch the oscilloscope OFF.

Remove the short-circuiting wire.

Switch the oscilloscope ON.

7) R6023 : Astigmatism correction.

Locate and identify R6023 (7) on CRT-Board.

Press channel I GD pushbutton (GD LED lit).

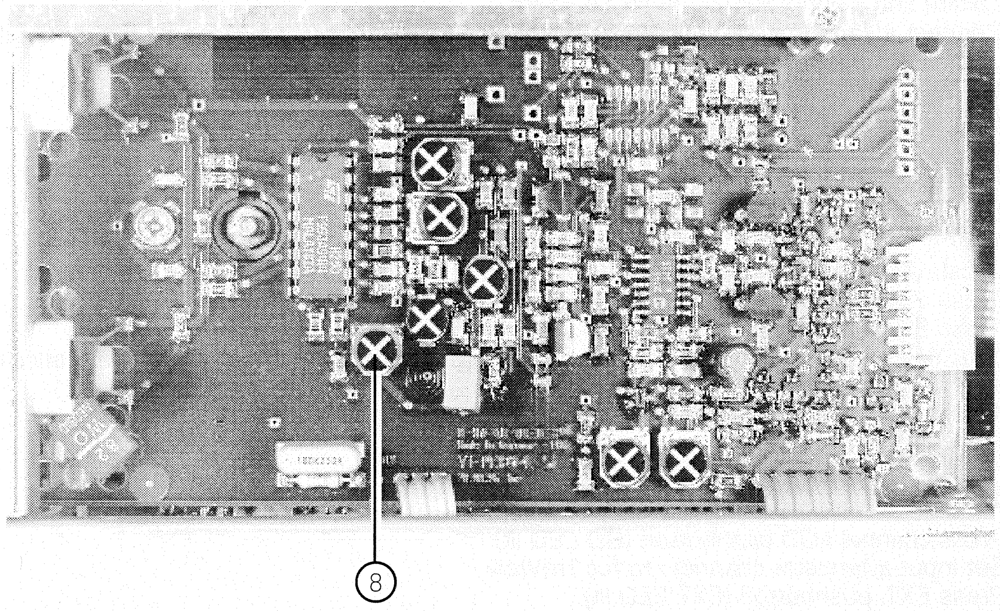
Press XY pushbutton (XY LED lit).

Adjust INTENS. (front panel) for low intensity.

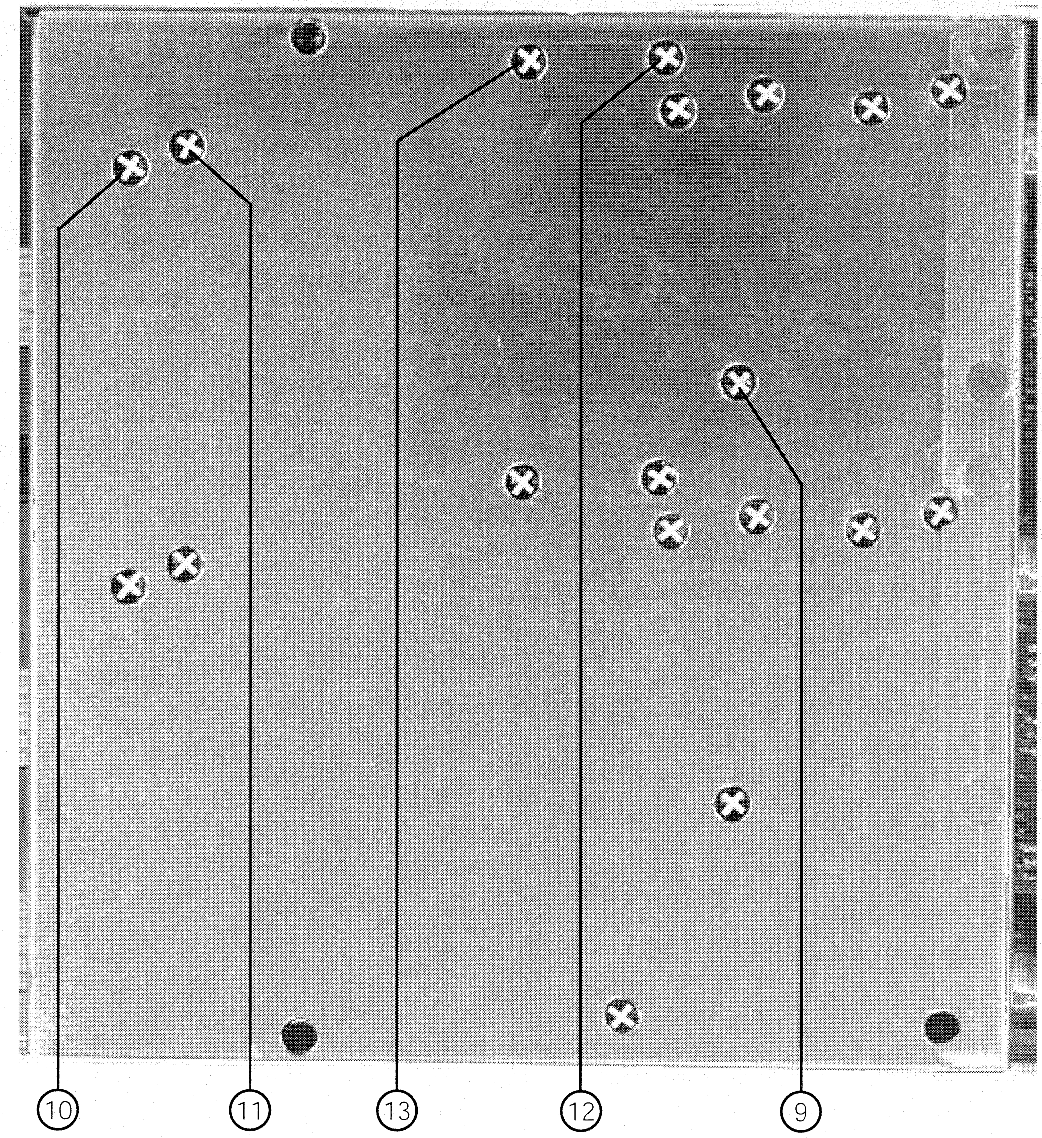
Turn the FOCUS knob continuously to defocus the spot in both directions from the focus point until the next procedure is finished.

Adjust R6023 (7) so that the spot shape does not change when defocussed.

YF-Board



AT-Board



8) R4023: Y-Gain CH I.

Locate and identify R4023 (8) on YF-Board.
Connect a 25mVpp/1kHz square wave signal via 50Ω cable and 50Ω through terminator to input channel I.
Set time base to 1ms/div.
Adjust R4023 (8) for 5 division signal height.

Note: *This adjustment affects Y-Gain CH II.*

9) R2189: FET operating point CH I.

Locate and identify R2189 (9) in CH I section of the AT-Board.
Press channel I GD pushbutton (GD LED lit).
Press EXT. pushbutton (EXT LED lit).
Turn Y-POS. I knob to set the trace exactly on the horizontal center line of the graticule.
Press channel I GD pushbutton (GD LED dark).
Adjust R2189 (9) for the same Y-position as before when grounded.

10) R2141: Invert-Balance CH I.

Press channel I GD pushbutton (GD LED lit).
Set input attenuator channel I to for 1mV/div.
Press EXT. pushbutton (EXT LED lit).
Locate and identify R2141 (10) on AT-Board.
Press, release and press channel I INV pushbutton continuously.
Adjust R2141 (10) so that the baseline will not move, when switching the invert function on and off.

11) R2131: Variable-Balance CH I.

Press channel I GD pushbutton (GD LED lit).
Set input attenuator channel I to 1mV/div.
Press EXT. pushbutton (EXT LED lit).
Locate and identify R2131 (11) on AT-Board.
Adjust R2131 (11) so that the baseline does not move when turning the channel I VAR. 2.5:1 knob through the entire range.

Check adjustment 10) again and repeat it if required.

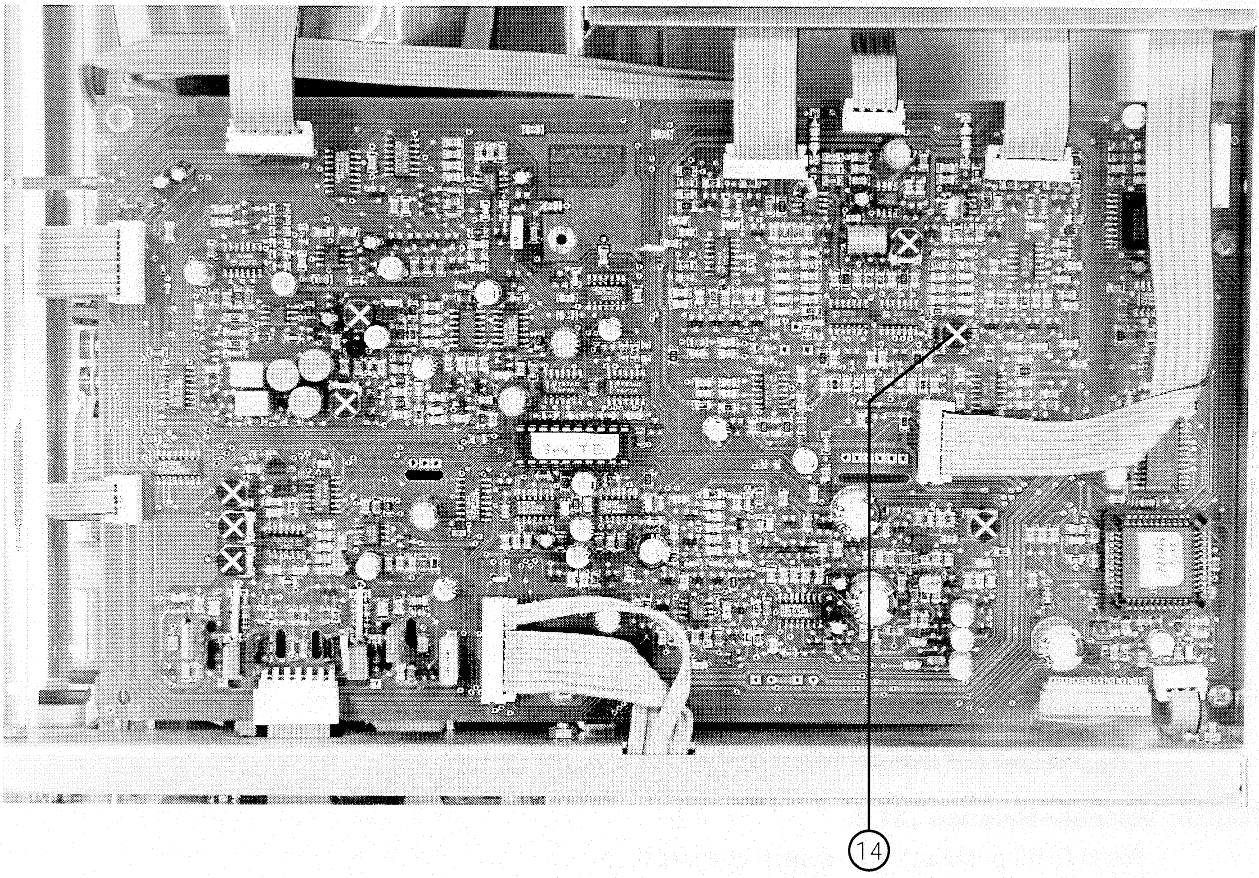
12) R2000: 10Hz Squarewave 5mV/div CH I.

Locate and identify R2000 (13) in CH I section of the AT-Board.
Connect a 25mVpp/10Hz square wave signal via 50Ω cable and 50Ω through terminator to input channel I.
Set time base to 10ms/div.
Adjust R2000 (12) for flat top.

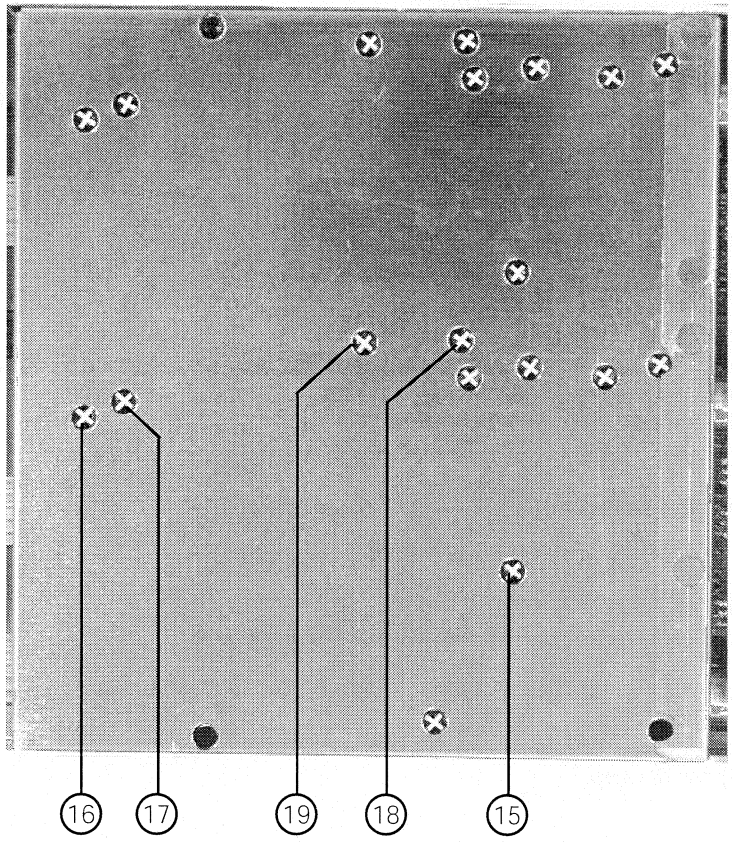
13) R2002: 10Hz Squarewave 1mV/div Adjustment CH I.

Locate and identify R2002 (13) in CH I section of the AT-Board.
Connect a 5mVpp/10Hz square wave signal via 50Ω cable and 50Ω through terminator to input channel I.
Set input attenuator channel I to 1mV/div
Set time base to 10ms/div.
Adjust R2002 (13) for flat top.

MB-Board



AT-Board


16
17
19
18
15

14) R3403: Y-Gain CH II.

Note: *The adjustment under item 8) must be finished before this procedure is started.*

Locate and identify R3403 (14) on MB-Board.
Connect a 25mVpp/1kHz square wave signal via 50Ω cable and 50Ω through terminator to input channel II.
Set time base to 1ms/div.
Adjust R3403 (14) for 5 division signal height.

15) R2389: FET operating point CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Locate and identify R2389 (15) in CH II section of the AT-Board.
Press channel II GD pushbutton (GD LED lit).
Press EXT. pushbutton (EXT LED lit).
Turn Y-POS. II knob to set the trace exactly on the horizontal center line of the graticule.
Press channel II GD pushbutton (GD LED dark).
Adjust R2389 (15) for the same Y-position as before when grounded.

16) R2341: Invert-Balance CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Press channel II GD pushbutton (GD LED lit).
Set input attenuator channel I to 1mV/div.
Press EXT. pushbutton (EXT LED lit).
Locate and identify R2341 (16) on AT-Board.
Press, release and press channel II INV pushbutton continuously.
Adjust R2341 (16) so that the baseline does not move, when switching the invert function on and off.

17) R2226: Variable-Balance CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Press channel II GD pushbutton (GD LED lit).
Set input attenuator channel II to 1mV/div.
Press EXT. pushbutton (EXT LED lit).
Locate and identify R2226 (17) on AT-Board.
Adjust R2226 (17) so that the baseline will not move when turning the channel II VAR. 2.5:1 knob through the entire range.

Check adjustment 16) again and repeat it if required.

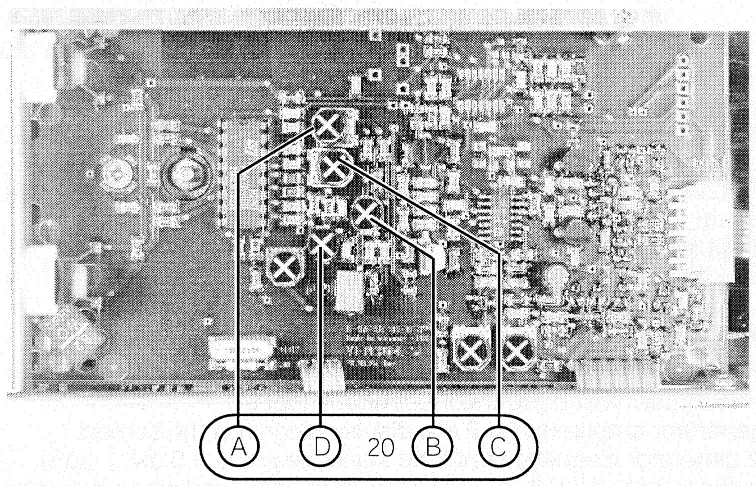
18) R2200: 10Hz Squarewave 5mV/div CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Locate and identify R2200 (18) in CH II section of the AT-Board.
Connect a 25mVpp/10Hz square wave signal via 50Ω cable and 50Ω through terminator to input channel II.
Set time base to 10ms/div.
Adjust R2200 (18) for flat top.

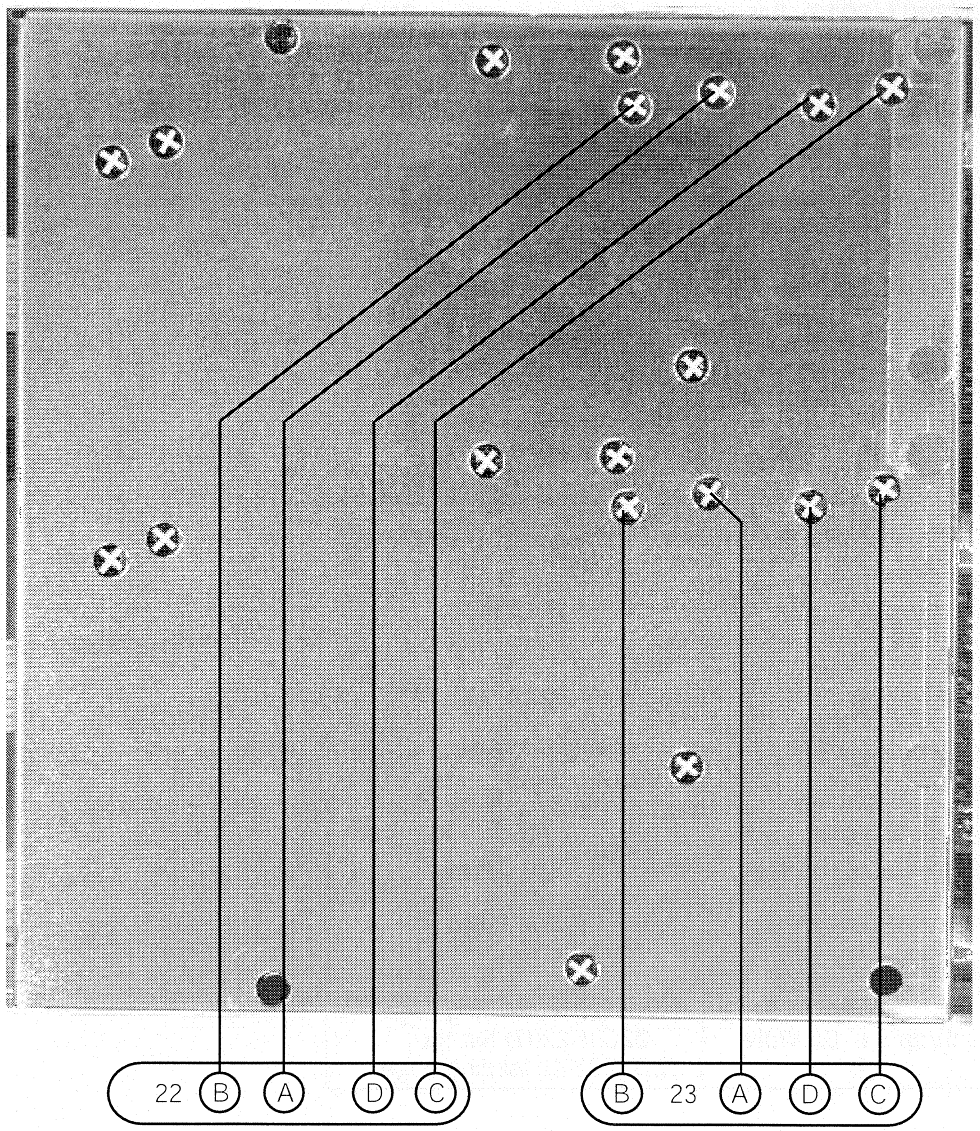
19) R2202: 10Hz Squarewave 1mV/div CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Locate and identify R2202 (19) in CH II section of the AT-Board.
Connect a 5mVpp/10Hz square wave signal via 50Ω cable and 50Ω through terminator to input channel II.
Set input attenuator channel II to 1mV/div
Set time base to 10ms/div.
Adjust R2202 (19) for flat top.
Adjust R434 (20) for flat top.

YF-Board



AT-Board


22
B
A
D
C
B
23
A
D
C

20) R4075 (A), R4063 (C), C4009 (B) and C4004 (D): Y-Final Amplifier.

Connect a 1MHz square wave signal of 25mVpp via 50Ω cable and 50Ω throughtermination to input CH I.
Set time base to 0.2µs/div.
Locate and identify the adjustment points R4075 (20A), R4063 (20C), C4009 (20B) and C4004 (20D) on MB-Board.
Adjust R4075 (20A) and C4009 (20B) for flat top, R4063 (20C) and C4004 (20D) for fast leading edge with minimum overshoot.
Repeat until optimum is obtained.
Check channel II under the same conditions.

21) Y-Amplifier Bandwidth Check.

Connect a 40mVpp/50kHz sinewave signal from a constant amplitude generator via a 50-Ohm throughtermination to the input of channel I.
Adjust the generator amplitude for 8 div. display height on the screen.
Increase the generator frequency until the signal height is 5.6 div. (-3dB).
Repeat the adjustment under item 20), if the frequency reading on the generator shows a value less than 35 MHz.

Repeat the same procedure under channel II operating conditions.

22) C2009/2013/2007/2012: Attenuator Compensation CH I.

Locate and identify trimmers C2007, 2012, 2009 and 2013 in CH I section of the AT-Board.
Set time base switch to 0.2ms/div.
Set amplitude calibrator to 1kHz, connect a 50Ω cable at the generator output and via a 2:1 pre-attenuator to input of CH I.
Set calibrator output voltage to 80mVpp (40mVpp at the 2:1 pre-attenuator output).
Check for 8 divisions signal height (5mV/div. attenuator setting).
Adjust trimmer in pre-attenuator for flat square wave top. This adjustment must not be changed during the following procedure.
Adjust compensation as listed in the table below:

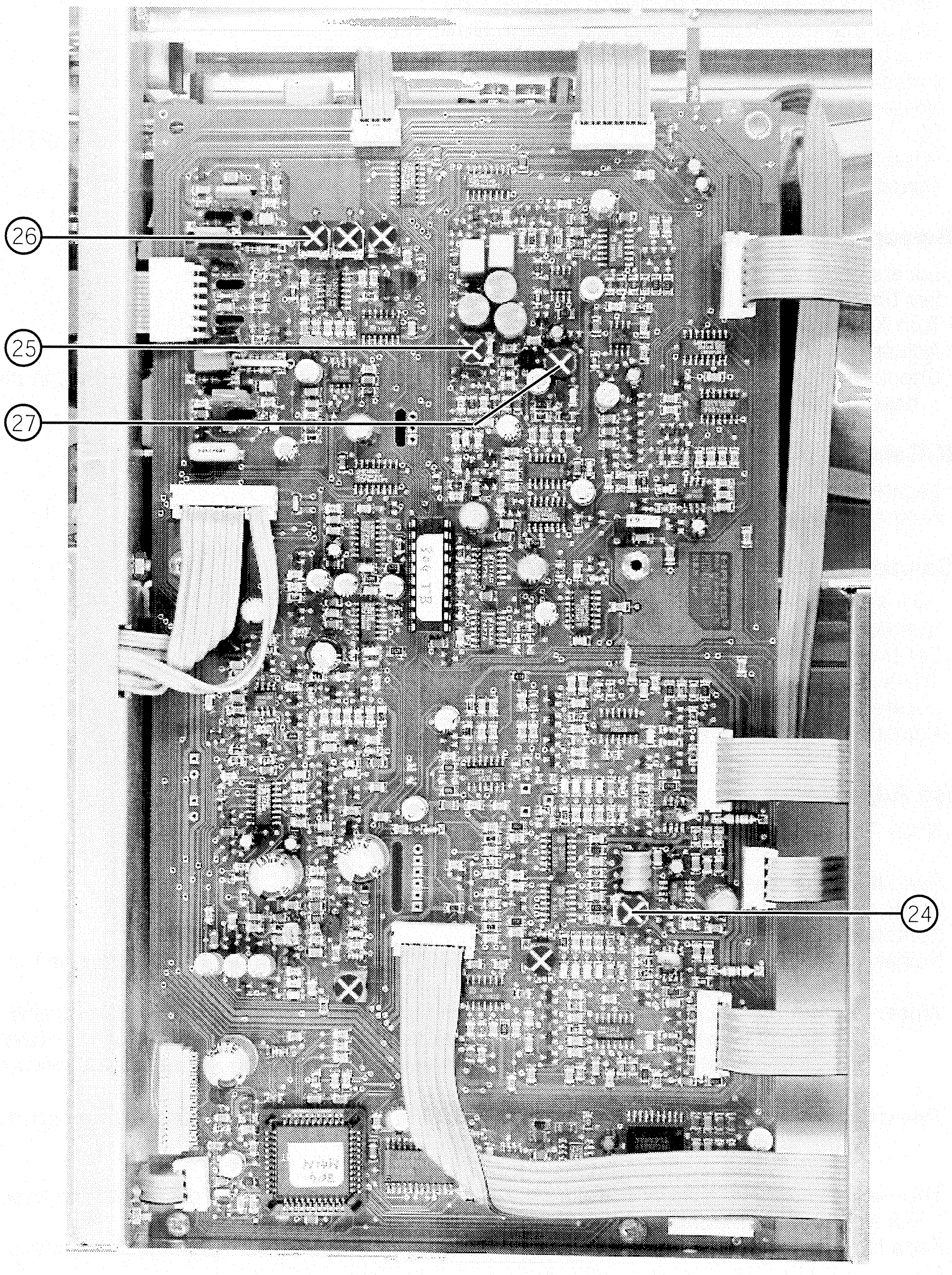
Scope Input	Input Atten.	Adjustment CH I
250mVpp	50mV/div	22A (C2009) flat top 22B (C2013) leading edge
2.5Vpp	0.5V/div	22C (C2007) flat top 22D (C2212) leading edge

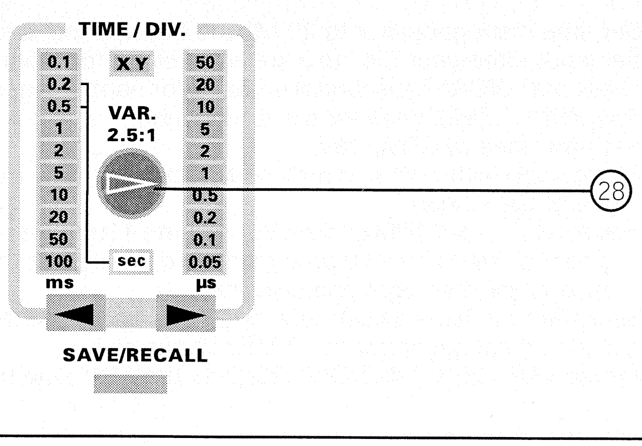
23) C2209/2213/2207/2212: Attenuator Compensation CH II.

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Locate and identify trimmers C2207, 2212, 2209 and 2213 in CH II section of the AT-Board.
Set time base switch to 0.2ms/div.
Set amplitude calibrator to 1kHz, connect a 50Ω cable to the generator output and, via a 2:1 pre-attenuator to input of CH I.
Set calibrator output voltage to 80mVpp (40mVpp at the 2:1 pre-attenuator output).
Check for 8 divisions signal height (5mV/div. attenuator setting).
Adjust trimmer in pre-attenuator for flat square wave top. This adjustment must not be changed during the following procedure.
Adjust compensation as listed in the table below:

Scope Input	Input Atten.	Adjustment CH II
250mVpp	50mV/div	22A (C2209) flat top 22B (C2213) leading edge
2.5Vpp	0.5V/div	22C (C2207) flat top 22D (C2212) leading edge

MB-Board


26
25
27
24


TIME / DIV.
0.1
0.2
0.5
1
2
5
10
20
50
100
ms
XY
VAR.
2.5:1
sec
50
20
10
5
2
1
0.5
0.2
0.1
0.05
µs
28
SAVE/RECALL

24) R3613: ADDition/Offset.

Press CH II pushbutton to switch channel II on.
Check that the oscilloscope is operated in DUAL mode.
Locate and identify R3613 (24) on MB-Board.
Press channel I GD pushbutton (GD LED lit).
Press channel II GD pushbutton (GD LED lit).
Move both baselines with Y-POS. I and II knobs to the horizontal center line of the graticule.
Press CH I and CH II pushbuttons simultaneously (ADD LED lit).
Adjust R3613 (24) for the same signal position as before in DUAL mode.

25) R4430: Sweep Start Position.

Locate and identify R4430 (25) on MB-Board.
Set time base to 0.1ms/div.
Turn X-POS. knob to the right stop (cw).
Adjust R4430 (25) for a trace start at the CRT center.
Check the maximum trace start position for a deviation of not more then 1 division, in the time base ranges from 0.1ms/div up to 0.1µs/div.

26) R4841: X-Gain x1.

Locate and identify R4841 (26) on MB-Board.
Adjust R4841 (26) for 10.2 div sweep length.

27) C4411: Sawtooth Start Linearity.

Turn X-POS. knob to the right stop (cw).
Connect a 40mVpp/1MHz triangle signal to input of channel I.
Set time base to 2µs/div.
Press X-MAG. x10 pushbutton (x10 LED lit).
Locate and identify C4411 (27) on MB-Board.
Adjust C4411 (27) for a linear slope at the trace start.

28) Time Base Adjustment.

Note: The oscilloscope must first be switched to the adjustment mode.

Switch the oscilloscope OFF.
Press and hold in the AUTO SET pushbutton.
Switch the oscilloscope ON.
Release the AUTO SET pushbutton after approx. 2 seconds (no further LED activities).

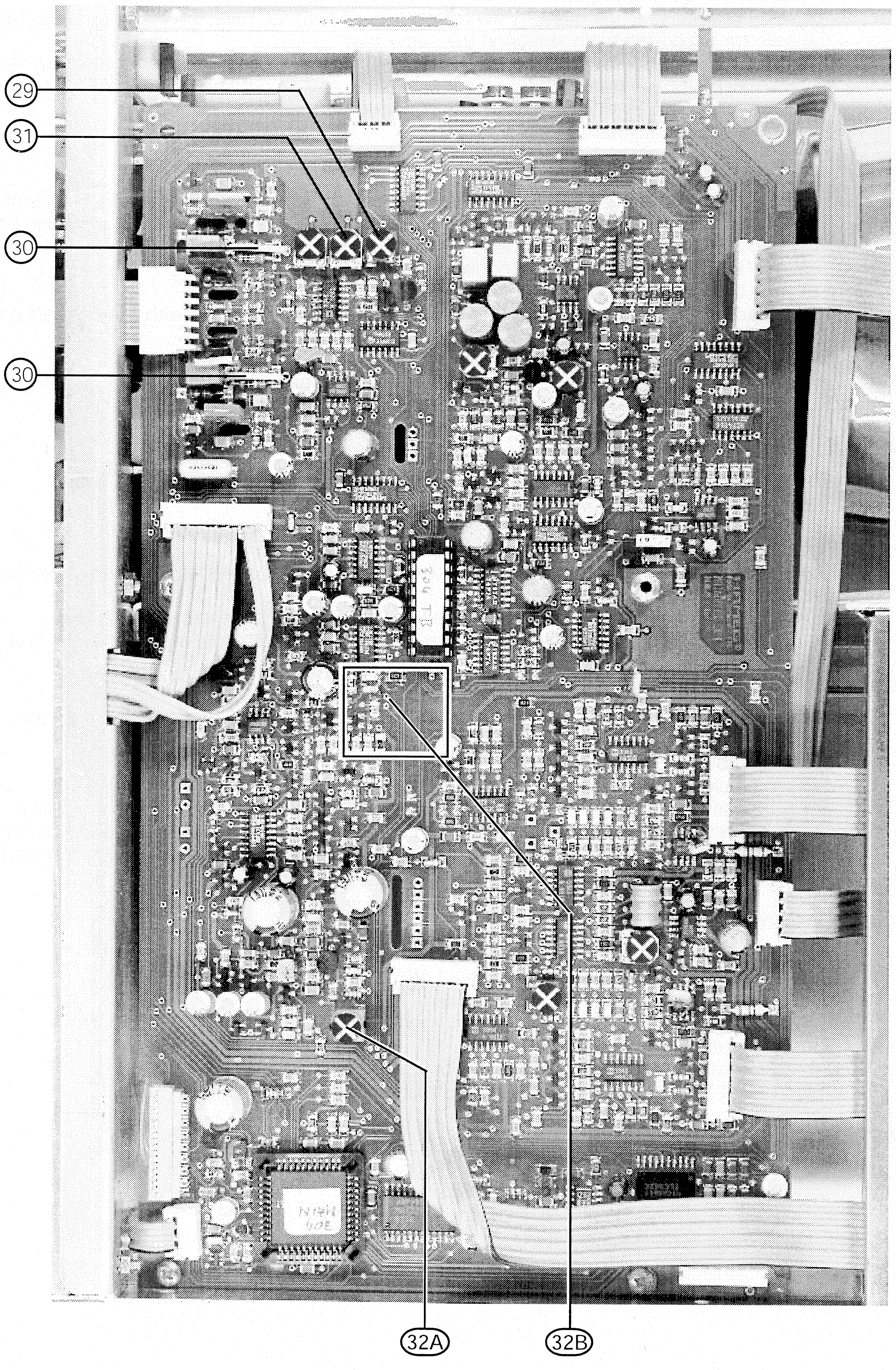
Note: *Now the adjustment mode is present. Any change of the VAR. 2.5:1 knob (28) in the TIME/DIV. section of the front panel causes a new adjustment of the selected time coefficient. After the TIME/DIV. setting was changed, the adjustment is stored.*

Remark: *The horizontal center line of the graticule must be used for the reading to avoid uncertainties due to deflection unlinearities.*

The manual contains a list of frequencies which must be used for the different time base settings if a sine wave generator is used for adjustment purposes.
For a high accuracy use the zero (voltage) crossing of a sine wave signal for the reading.

Set time mark generator to 20 MHz (0.05µs/period) and connect the signal to CH I input.
Set input attenuator CH I to a suitable setting for a signal display of approx. 4 divisions height.
Press both NORM pushbuttons briefly for normal triggering mode (NM LED lit).
Turn TRIG. LEVEL knob for exact triggering.
Set time base to 0.05µs/div.
Move trace with X-Pos. control so that the first time mark coincides with the first left graticule line of the screen.
Rotate VAR. 2.5:1 (TIME/DIV) (28) until the 11th time mark coincides with the last right graticule line. If only 10 time marks are visible, set the 10th time mark on the last but one (next to the last) right graticule line.
Save the time base adjustment by switching over to the next TIME/DIV. setting (0.1µs/div.).
Set time mark generator to 10 MHz (0.1µs/div).
Rotate VAR. 2.5:1 (TIME/DIV) (28) until the 11th time mark coincides with the last right

MB-Board


29
31
30
30
32A
32B

graticule line. If only 10 time marks are visible, set the 10th time mark on the last but one (next to the last) right graticule line.
Save the time base adjustment by switching over to another TIME/DIV. setting (0.2µs/div.).
Operate for each time base setting in the same way.
After the last adjustment was made (e.g. 0.5s/div), the last VAR. 2.5:1 setting must not be changed.
Switch the time base from 0.5s/div. back to 0.2s/div.and do not change the VAR. 2.5:1 knob.
Switch the oscilloscope OFF to leave the adjustment mode.
Now all time base adjustments are stored.

Switch the oscilloscope ON.
Set time mark generator to 20 MHz (0.05µs/period) and connect the signal to CH I input.
Set input attenuator CH I to a suitable setting for a signal display of approx. 4 divisions height.
Press both NORM pushbuttons briefly for normal triggering mode (NM LED lit).
Turn TRIG. LEVEL knob for exact triggering.
Set time base to 0.05µs/div.
Move trace with X-Pos. control so that the first time mark coincides with the first left graticule line of the screen.
Rotate time base variable control to fully left position.
Now more than 2.5 time marks per division must be displayed.
Check all TIME/DIV. settings with suitable signals in the same way.

29) R4840: X-Magnification x10.

Locate and identify R4840 (29) on MB-Board.
Press pushbutton X-Mag. x10 (x10 LED lit).
Set time base to 1µs/div.
Set time mark generator to 10 MHz and connect signal to channel I input.
Set input attenuator CH I to a suitable setting for a signal display of approx. 4 divisions height.
Set X-POS control to mechanical center.
Using X-POS control, move the first visible time mark to the first left graticule line.
Adjust R4840 (29) so that the next time mark coincides with the last (right) graticule line.

30) X-Deflection Linearity.

Locate and identify 2 wires - C 4809 and 4810 - (30) near the X-final amplifier transistors on MB-Board. Each wire is parallel to two resistors.
Press pushbutton X-Mag. x10 (x10 LED lit).
Set time base to 0.1µs/div.
Set time mark generator to 100 MHz and connect signal (approx. 60mVpp) to channel I input.
Carefully press or release the wires (29) with an insulated tool until 1 signal period coincides with each graticule line over the entire X-POS. control range. Deviations of < 1mm can be tolerated unless out of specification (± 5%).

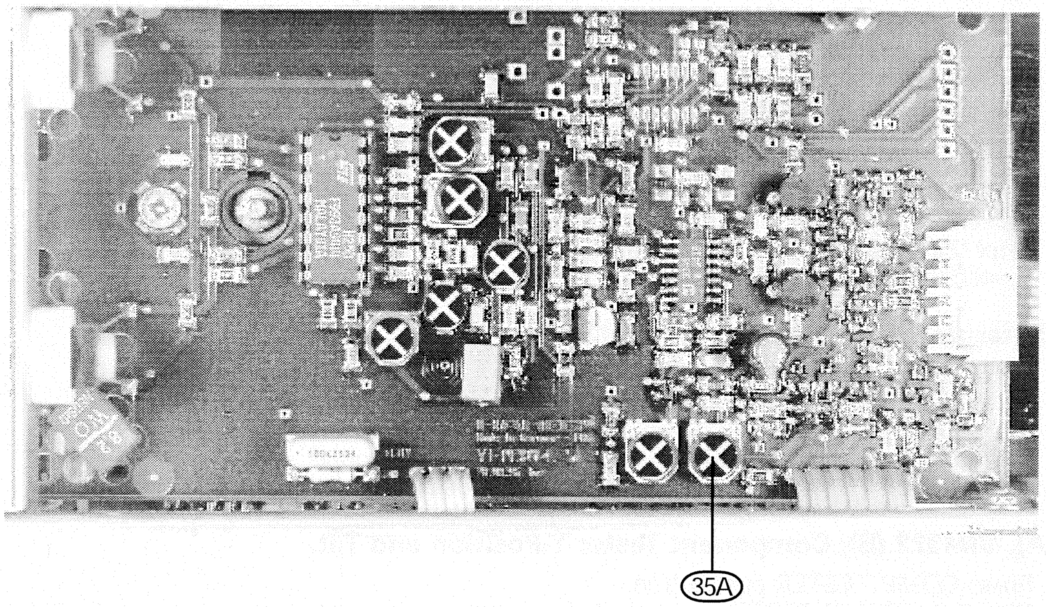
31) R4839: XY-Gain

Press CH II pushbutton to switch channel II on.
Press CH I pushbutton to switch channel I off.
Locate and identify R4839 (31) on MB-Board.
Connect a 10kHz square wave signal of 25mVpp amplitude (HZ60-2) to input CH II.
Press XY pushbutton (XY LED lit).
Set X-POS control that the left dot coincides with the graticule center.
Adjust R624 (32) for a distance of 5 division between left and right dot.

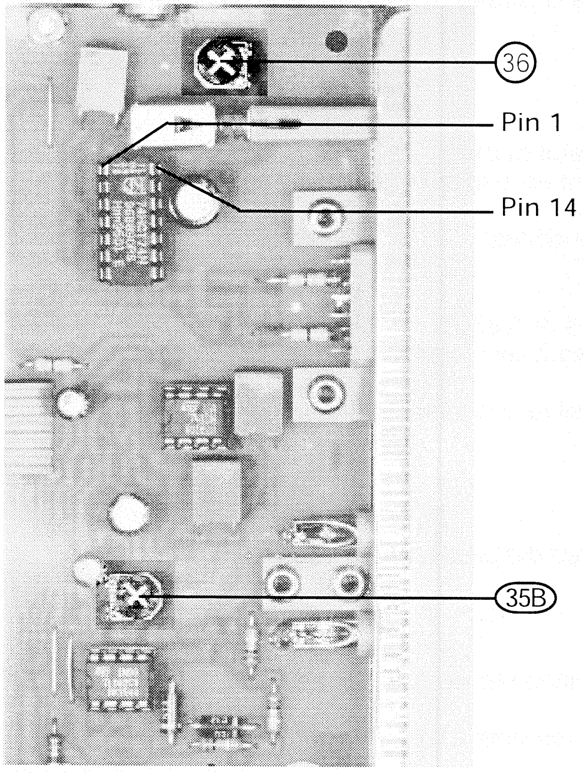
32) R5028: Trigger Operating Point.

Locate and identify R5028 (32A) on MB-Board.
Locate and identify MP1 (32B) on MB-Board.
Measure the DC voltage at 32B with respect to ground.
Adjust R5028 (32A) for +2.5Volt (± 10mV).

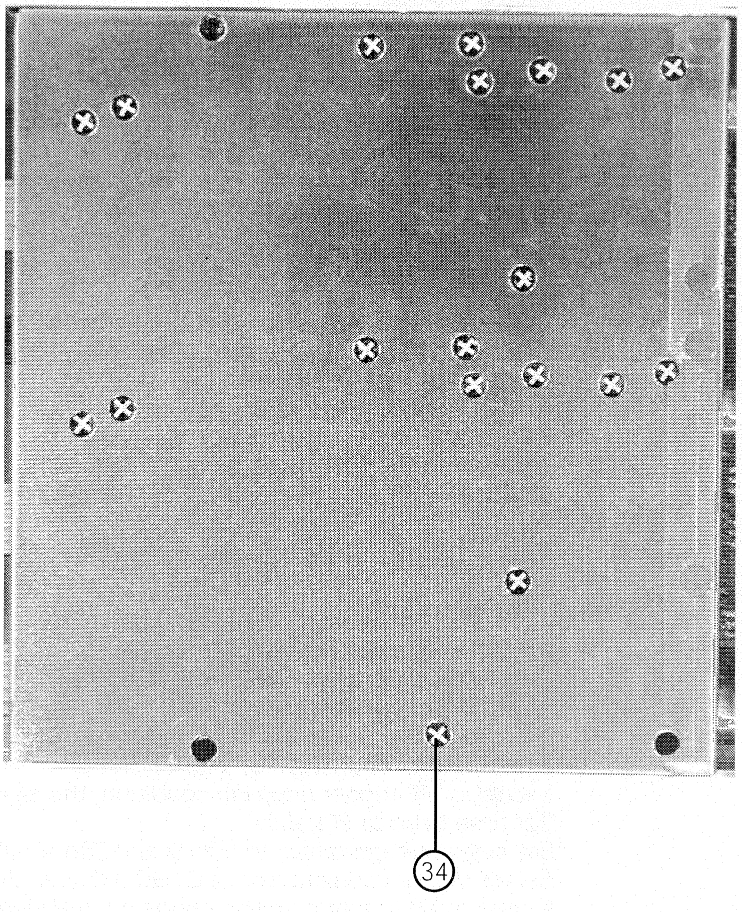
YF-Board



CT-Board


36
Pin 1
Pin 14
35B

AT-Board



33) Peak to Peak Trigger Operating Point.

Note: *The oscilloscope must first be switched to the adjustment mode.*

Switch the oscilloscope OFF.

Press and hold in the AUTO SET pushbutton.

Switch the oscilloscope ON.

Release the AUTO SET pushbutton after approx. 2 seconds (no further LED activities).

Press both NORM trigger pushbuttons in simultaneously.

Release both NORM trigger pushbuttons after the TRIG. LED has started blinking.

After the TRIG. LED has stopped blinking, the adjustment is finished.

Switch the oscilloscope OFF to leave the adjustment mode.

34) R2433: External Trigger Operating Point.

Press EXT pushbutton (EXT LED lit).

Locate and identify R2433 (34) on AT-Board.

Locate and identify MP1 (32B) on AT-Board.

Measure the DC voltage at MP1 (32B) with respect to ground.

Adjust R2433 (32A) for +2.5Volt (± 10mV).

35) R4004 (A), VR4322 (B): Component Tester Y-Position and Tilt.

Press COMP. TESTER pushbutton.

Now if the COMP. TESTER input sockets are not connected, a trace of approx. 7 - 8 division length must be visible.

Locate and identify R4004 (35A) on YF-Board.

Adjust R4004 (35A) to shift the horizontal component tester trace to the horizontal center of the CRT graticule.

Locate and identify VR4322 (35B) on CT-Board.

Set up the instrument on a table in normal operating conditions to avoid misadjustment due to the influence of the earth magnetic field.

Adjust VR4322 (35B) in such a way that the trace is parallel to the horizontal graticule center line and not tilted.

36) VR8940: Calibrator Output.

Locate and identify VR8940 (36) on CT-Board.

Connect a digital multimeter to the 0.2Vpp calibrator output.

Set up the digital multimeter for DC measurement on a suitable sensitivity setting.

Locate and identify IC8903 on CT-Board.

Connect pin 1 and pin 14 of IC8903 galvanically together.

Adjust VR8940 (36) for exactly 200mV ± 1mV DC.

Check 2V calibrator output.

Remove the connection between pin 1 and pin 14 of IC8903.

Connect a 10:1 probe to the 0.2Vpp calibrator output and connect it to the CH I input of the scope.

Set time base to 0.2ms/div.

Now approximately 2 signal periods should be visible on the screen.

Press 1kHz/1MHz pushbutton (in!).

Set time base to 0.5µs position.

Check 1MHz calbrator signal.

Please note: *Neither the calibrator frequency nor the pulse duty factor are specified.*

37) Trigger Filter Check.

Set time base to 1ms/div.

Connect a 1kHz sinewave signal of 25mVpp amplitude to input CH I and check for full screen deflection.

Set input attenuator CH I to 50mV/div and check for 5mm display height.

Select trigger coupling AC, DC, HF and LF.

Except in HF trigger coupling condition, the signal must always trigger the oscilloscope.

Set time base to 20µs/div.

Set sinewave generator to 50kHz and 25mV output amplitude and check for 5mm display height.

Select trigger coupling from AC, DC, HF and LF.

Except in LF trigger coupling condition, the signal must always trigger the oscilloscope.

38) Triggerbandwidth Check.

Set time base to 0.05µs/div.
Connect a 100MHz sinewave signal to input CH I.
Adjust generator output for 5mm display height.
The signal must be triggered.

39) External Trigger Check.

Set time base to 20µs/div.
Set input attenuator CH I to 0.1V/div.
Connect a 50kHz sinewave signal via a 50Ω through terminator with an amplitude of 280mVpp (100mVrms) to input CH I and check for 2.8div display height.
Set TRIG. LEVEL to midrange position.
Check that the Trigger-LED is lit.
Press EXT. pushbutton (EXT LED lit).
The TRIG. LED now must be dark.
Press GD pushbutton channel I (GD LED lit).
Remove signal cable from input CH I and connect it to the TRIG.INP. socket.
Now the TRIG. LED must lit.